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CONTENTS.

PAGE

Circular to Gas Companies 333

Correspondence:—

On Coal Gas as a source of Heat 335

Register of New Patents:—

H. Carter, for certain improvements in the production of light from ordinary coal gas by the use of burners consisting of more than one ring or sheet of flame combined with a suitable chimney, and supplied with atmospheric air adapted also to ventilation .. 336

R. Laming and F. J. Evans, for improvements in the manufacture of gas for illumination and other purposes to which coal gas is applicable, in preparing materials to be employed in such manufacture, and in apparatus for manufacturing and using gas .. 337

G. Michiels, for improvements in treating coal, and in the manufacture of gas, and also in apparatus for burning gas 340

Miscellaneous:—

Royal Scottish Society of Arts 342

Great Central Gas Consumers' Company 343

Association of Gas Fitters 345

Cooking by Gas 345

Gas Lighting in Italy 345

Reduction in the price of Gas 345

Frauds on Gas Companies 345

Lutterworth Gas Works 345

Kensall Green (Western) Gas Works 345

British and Foreign Gas Light and Meter Company 345

Universal Gas Light Company 345

Share List 346

AVIS

A MM. LES EXPOSANTS ÉTRANGERS DE L'EXPOSITION DE L'ANNÉE 1851.

Le Rédacteur du Journal d'Eclairage au Gaz a l'honneur d'annoncer aux inventeurs et propriétaires d'appareils pour la fabrication, distribution, et les emplois à l'usage du gaz, qu'il est pret a se charger de leurs intérêts, pour la grand exposition internationale de l'année prochaine. S'addresser franco au Rédacteur du Journal, 32, Bucklersbury, à Londres.

NOTICE TO AMERICAN READERS.

Complete series of the JOURNAL may be had of Messrs. D. Appleton and Co., 200, Broadway, New York, to whom all subscriptions for the United States, after the 10th of January, 1851, must be paid.

NOTICES.

The intimation conveyed in the last Journal, that we had it under consideration permanently to augment its size to twenty-four pages monthly, has produced so many and such unexpected expressions of a desire to see the intention carried out, that we have decided on putting it into immediate execution, and to commence the new volume with the issue of the enlarged Journal. The subscription will henceforward be ten shillings per annum, if paid in the course of January of each year, or two payments of six shillings each, if not paid in advance, due in July and January. In the United States of America, the subscription will be four dollars, payable in advance to Messrs. D. Appleton, 200, Broadway, New York. Should any of our present subscribers not wish to continue their subscription, we shall be obliged by their intimating the same before the 10th of January next.

A few copies of Vol. I. may now be had, price 16s. bound in cloth, or lettered cloth backs for binding are supplied by the publisher at 2s. 6d. each.

All communications and orders for Advertisements to be addressed to the Editor, 32, Bucklersbury, London.

Back numbers exceeding three months' date will in future be charged double price, unless six or more consecutive numbers are taken at the same time. Nos. 6, 12, 13, 15, 16, and 18, are nearly out of print, and can in future only be obtained with complete sets of the Journal.

The Editor will be particularly obliged by his friends forwarding to him Notices of all Meetings, Trials, or Appeals which it may be interesting to the Gas World to have reported.

Circular to Gas Companies.

The Editor may be consulted on all subjects connected with the supply and manufacture of gas, or the alteration and improvement of gas apparatus, and the construction of new works.

IT is a source of sincere satisfaction to us to find, at the termination of the labours of a second year, that the principles we were the first to promulgate, and have ever since advocated, are at length appreciated by some of the metropolitan gas companies, and that the first step has at last been taken by an important section of them, towards a more complete union of their conflicting interests, the requisite notices having been given during the past month for obtaining the sanction of the Legislature in the ensuing session of Parliament, to an act for the amalgamation of the Chartered Company, the Equitable Company, and the London (Vauxhall) Company, into one consolidated Company representing about 43 per cent. of the capital and income of the gas companies of the entire metropolis. We have good reason for believing that had the intention been generally known early enough, the circle of its operation might have been enlarged by the adhesion of some of the others. Our only regret is, that the measure has been so long delayed, but we have well grounded hopes that if such precautions are used in presenting it to the public as shall disarm any anti-monopoly cry which may be raised against it, the step will be approved of by the great mass of thinking people, and prevent the further sacrifice of the capital invested in these operations. We allude particularly to the admission of some popular controul by auditors, and officers appointed to watch over the quality of the gas supplied, and the accurate registration of the meters, who shall be nominated by public authorities, such as the Common Council of the City of London or the Board of Trade, and the publication of the accounts, or other such arrangements as shall give the public confidence in the economical and faithful administration of the affairs of the new company. It is also a question whether the maximum dividend allowed to be taken by the Gas Work Clauses Consolidation Act may not be materially reduced. We throw out these hints for the consideration of the parties interested, knowing the difficulties they will have to encounter in carrying out their project, and being sincerely anxious for its success.

Notices have been given of applications intended to be made in the ensuing session of Parliament for the undermentioned sixteen bills connected with the supply of gas in the towns named:—

BIRMINGHAM IMPROVEMENT BILL, to enable the mayor, aldermen, and burgesses to supply gas, or to contract for the supply, and to erect gas-works, or to purchase or take on lease any existing gas works, and to enable any existing gas companies to transfer their powers.

DEWSBURY GAS AMENDMENT ACT, to extend the powers of a previous act to the whole of the parish of Dewsbury and the township and parish of Batley, and to raise further capital.

ELLAND IMPROVEMENT BILL, to authorize the commissioners to purchase, by compulsion or otherwise, the works and mains of the existing gas company, and to levy rates for the supply of gas. Also to raise money for the purposes of the act.

GAS LIGHT AND COKE COMPANY (CHARTERED), EQUITABLE GAS COMPANY, AND LONDON GAS COMPANY (VAUXHALL) AMALGAMATION AND AMENDMENT ACT, to amalgamate the whole or any two of the above companies, and to vary or extinguish certain rights conferred by previous acts.

GREAT CENTRAL GAS CONSUMERS' COMPANY, to incorporate a company with power to light the parish of St. Leonard, Bromley; the hamlet of Mile End Old Town; St. Botolph, Aldgate; St. Mary, Whitechapel; Holy Trinity, Minories; St. Sepulchre; and so much of Bethnal-green as is included in Mile End Old Town, and a line parallel to and fifty feet northward of the Whitechapel and Mile End-roads.

GREAT MALVERN IMPROVEMENT BILL, to authorise the appointment of commissioners with power to establish gas works and to supply gas, or to contract with any company, body, or persons so to do, or to purchase works and mains.

HASTINGS IMPROVEMENT BILL, to enable the commissioners to supply gas, or to contract for its supply, or to erect works and lay down mains.

HARWICH IMPROVEMENT BILL, to enable the mayor, aldermen, and burgesses to contract with any company, or persons, for the supply of gas.

HARWICH IMPROVEMENT COMPANY, to incorporate a company having power to purchase and sell gas.

IMPERIAL CONTINENTAL GAS ASSOCIATION AMENDMENT ACT to enlarge and alter powers of previous acts relating to the borrowing of money, for amalgamating shares, and for other purposes.

LEEDS IMPROVEMENT AMENDMENT ACT, to amend and enlarge previous acts so as to enable the mayor, aldermen, and burgesses to make and sell gas; to establish gas works and lay down pipes, and to purchase by agreement or compulsion lands and houses. Also to purchase the lands, tenements, and hereditaments of the Leeds Gas Light Company, and the Leeds New Gas Light Company, and to raise money by loan for the purposes of the intended bill.

MANCHESTER IMPROVEMENT ACT to alter and amend previous acts, and to obtain power to alter the mode of application of the surplus profits arising from the gas works already constructed under the authority of previous acts in such manner as shall be from time to time decided by the Town Council, and also to exempt the gas works from all parochial and other rates.

PILLGWENLLY AND NEWPORT GAS CONSUMERS' COMPANY, to incorporate a company, or to amalgamate with the Newport Gas Company, or to lease or purchase their works.

SCARBOROUGH GAS COMPANY, to incorporate the existing company with power to raise additional capital, and to extend the works to the municipal borough.

SUNDERLAND IMPROVEMENT ACT, to enable the mayor, aldermen, and burgesses to supply gas, or to contract with any company or persons for the supply, or to purchase any existing gas work, and to raise money for such purposes; also to enable the Sunderland Corporation Gas Company to sell and transfer their works, powers, and privileges to the mayor and corporation.

WESTON SUPER MARE IMPROVEMENT AMENDMENT ACT, to enable the commissioners more effectually, wholly or in part, to manufacture and supply gas to the inhabitants, or to purchase, lease, or contract with any existing gas company, or to advance or lend money for the purpose of enabling any existing company more effectually to supply the town with gas.

It is worthy of remark that of these one half are applications for authority to invest the lighting of the towns in question, either in the corporations or in commissioners, and this amply demonstrates the correctness of the observation we lately made upon the increasing disposition of public men to vest the supply of gas and water to populous towns in the hands of commissioners or other municipal bodies. Leeds and Birmingham seem disposed to follow the example of Manchester in this respect, though they can never expect to attain the same degree of prosperity, having allowed companies to establish works which they must now either purchase on equitable terms, or encounter a ruinous competition from, the result of which must be doubtful. Besides, no other city in the empire except Manchester can show such a result as the sale of 401,000,000 feet of gas per annum, with only 120 miles of mains, and a capital of £311,447, of which only £90,350 is now bearing interest. Some of these bodies are evidently not very proficient in their duties, and if all were to have recourse to the method adopted by the Boston commissioners, whose repeated advertisements in London daily and weekly papers, as well as provincial ones, for a contract amounting to 30s. or 40s.,* has been the laughing-stock of meter-makers during the last month, they had better call to their aid some more experienced advisers before drawing upon themselves the derision of those who are acquainted with their duties. It must not be inferred from these remarks that we object to the assumption of these duties by municipal authorities; when carried out with intelligence they confer a public benefit, and if, instead of seeking to destroy gas companies by promoting ruinous competition, they would take their properties at fair valuations and work them on public account, few companies would, we are persuaded, object to relinquish them on equitable conditions.

The attempt made in our last to group the different descriptions of coal used in gas-works, according to the quality of the gas yielded by them, and the values of their surplus residuary products, has met with general approbation for its accuracy, and as the first step towards a better understanding of the "gas question" by the public. We have been rewarded by the complimentary remarks of some members of the public press, upon whom the information conveyed will not be thrown away. It has been suggested to us that the value we have assigned to the surplus residuary products can only be obtained in large works, and in the late edition of last month's Journal, we added the word "larger" before "towns enumerated," so as to obviate this objection. The only real objector to our classification has been the manager of the Blackburn Gas Works, who sends us the following detail of some experiment he has lately made, to prove that we have undervalued the gas produced by Wigan cannel:—

Description of Burner.	Gas Consumed per Hour.	Grains of Sperm consumed per Hour.	Number of Candles each Burner was equal to.
1 Jet	·438	130·8	1
1 Jet, 4 inches high	·732	130·8	2
No. 3, Pot Burner	2·67	130·4	13
No. 3, do.	3·42	130 8	17
Batswing	4·	125·6	20
Do.	4·356	132·8	22
Do.	4·632	132·8	24

If these experiments are worth anything, they of course raise Wigan cannel gas above the value we have assigned to it; but knowing that the gentleman in question is not perfectly disinterested, and how difficult it is with the photometer he used to obtain accurate results, when the illuminating power exceeds fourteen or fifteen candles, we prefer the experiments which *he gives us*, as having been made by a disinterested person well skilled in such observations, with burners of lower powers, on Nov. 4 and 5 of the present year, upon the gas *ordinarily* supplied in Blackburn, and not *prepared especially for any experiments*. They are as follows:—

Description of Burner.	Gas Consumed per Hour.	Grains of Sperm consumed per Hour.	Number of Candles each Burner was equal to.
16-hole Argand	4·08	147.6	14¼
Batswing	4·02	150·	16
1 Jet 4¾ inches high	1·04	(not stated)	2

Our readers must draw their own conclusions from these statements, and raise the value if they see fit. We, however, see no reason for doing so, but are rather confirmed than otherwise in that already assigned to this description of gas.

A Scotch correspondent, who has had considerable experience in the use of the cannels not classed in the note appended to that group in our last, has given us some farther information respecting them, which it may be useful to embody here. One of these called by us the Blackbraes (also known by the name of Boghead and Bathgate), is a most extraordinary product. It is duller in colour and harder than the Lesmahago; and the indentations made by striking it with a blunt instrument are of a deep brown colour, resembling old wood. In its distillation it yields little tar and liquor, but as much as 11,500 or 12,000 feet of gas per ton, of which 5 feet are equal to 38 candles; so rich indeed is it as to be consumed with difficulty in burners of the usual description. Its principal use would, therefore, appear destined to be in conjunction with inferior coals and cannel, so as to improve the quality of their gases. The coke is worthless, containing upwards of 65 per cent. of earthy matter. Some doubt also is expressed as to whether the Monkland is *quite* equal to Lesmahago, and the amended classification will stand as follows:—

	Candles.	Ft. per Ton.	Residuary products worth
Blackbraes or Boghead } 5 feet equal to	38	11,500	5 per cent of cost of coal.
Old Wemyss	33	9,625	10 "
Lesmahago, 1st and 2nd var.	30	10,800	20 "
Arniston	30	10,800	20 "
Monkland	29	10,500	20 "
Marquis of Lothian	30	10,000	17½ "
Cappledrae	30	9,800	15 "
Lesmahago, 3rd sort	28	10,000	20 "
Methil	27	9,000	5 "
Kinniel	24	10,400	20 "
Grange	24	10,400	20 "
Skaterig	20	10,400	17½ "
Lochgelly	20	9,300	17½ "
Lumphinnan	20	9,300	17½ "

We regret that the "standard candles," to which we alluded in our last, are not yet ready for delivery; some we have had made lately are not so perfect as the first we procured, but we shall give notice when they are ready.

A Lancashire manufacturer of clay retorts has, we are informed, extensively circulated copies of a correspondence which has passed between the Editor of this Journal and himself, arising out of the refusal to insert certain passages in one of his communications, and he has accompanied them with an impertinent letter, in which our motives for so doing are offensively impugned, in language which we are satisfied will find but few admirers, and with a vulgarity of style in which he is evidently a proficient. We are at all times unwilling to admit into our Journal any personal controversies, or to take part, on the present occasion, in one originating in a squabble between two correspondents, but degenerating at last into an attempt to make us the vehicle for puffing certain wares. We shall, therefore, not disfigure our columns with the cor-

* The Boston Lighting Commissioners are prepared, through me, to receive on or before the 1st of December next, Plans, Specifications, and Estimate (from any competent party willing to furnish them) of a proper Meter for testing the consumption of gas in the borough of Boston, to be applied to a single street lamp to be pointed out by their surveyor. The commissioners to be at liberty to adopt or not the plan, &c., to be most approved of. By order, HENRY MARSHAL, Clerk.
Boston, 7th of November, 1850.

respondence, however tempted we may be to break a lance with a gaseous Quixote, through whose distorted vision each iron retort is magnified into a windmill, and whose armour is forthwith buckled on for its attack and destruction. Those who have read the correspondence will see that we expected to disarm him by the admission that we were "converts to the use of clay retorts," a confession which he takes care to draw particular attention to; and had we gone the length of confirming his statement that his retorts are "superior to, and cheaper than any hitherto manufactured," we presume we should have had the honour of being quoted in type more distinguished still. Far, however, from being thus disarmed, our valiant knight first taxes us with favouring the flight of a correspondent, whom he has the bad taste to designate as "a second Croll" (a plume which would more appropriately wave in his own helmet), "into the airy regions of *metaphysics*" (*sic*) in search of "the ultimate point of caloric which will produce the greatest quantity of gas of the best quality from a given weight of cannel," a charge he is compelled to abandon, and finally calls the drawing of his attention to a paper in which Dr. Fyfe saw reason to alter his *originally* formed opinion of the comparative value of Wigan cannel and Newcastle caking coal, an attempt to "mistify the subject further," asking, "Does any one *believe* that Dr. Fyfe ever" so stated, and himself triumphantly answering "*No one*," having at the same time the paper before him to which we referred, and in which such a change is announced. Now, either *we* have palmed off a forgery upon our readers, or our hot-headed correspondent has forgotten how to read, in the excitement consequent upon the inditing of his frothy defence against an imaginary injustice; but as the article to which we referred him has been before the public for upwards of a year, and no one has hitherto questioned its authenticity, it is rather too barefaced a simulation of ignorance now to deny the fact that a modified opinion has been promulgated by the gentleman alluded to, since the publication of that to which we were required to give new circulation; and on this was founded one of our objections to the admission of reference to experiments made eight or ten years ago, and which subsequent ones have rendered inapplicable to the present state of gas manufacture. If our correspondent desires that we should print *all* the communications we receive on clay retorts, we should furnish our readers with a long catalogue of places where the results obtained even by the use of those *manufactured by himself* do not exactly tally with his own, but very much the reverse. If, therefore, people will not buy his goods, because they can purchase better or cheaper ones elsewhere, surely it is too bad of him to vent his spleen upon us, "the head and front of whose offending" is, that, in the exercise of our discretion, we struck out of his communication a passage in which Dr. Fyfe is made to state that the value of Wigan cannel is from 2·23 to 2·5 compared to Newcastle coking coal as 1, and the passages depending upon it, assigning what we maintain to be a sufficient reason. Conscious of the rectitude and impartiality of our conduct in this matter, we abstain for the present from any further remarks upon it, but shall be happy to forward copies of the correspondence (in which the passages we objected to are indicated by italic print) to such subscribers taking an interest in the matter, as may desire to have the same transmitted to them; and we trust that the renewed expression of our determination rigidly to exclude from our columns all approach to personalities, will be the cause of such continued care on the part of our correspondents as shall render needless the exercise of that discretion which we claim to hold in the selection of such portions of their communications as seem to us worthy of being made public.

It appears, however, that we are not the only parties who feel themselves aggrieved by the course pursued by this valiant knight-errant, the following letter having been addressed to him by the manager of the Warrington Gas Works, which we are authorized to insert:—

"Warrington, Nov. 29, 1850.

"DEAR SIR,—I am in receipt of a pamphlet this morning, I suppose from you. In your letter dated Nov. 20, 1850, at the foot of page 4, you say, 'I have eye-witnesses to prove, &c. &c.' Your statement there is incorrect. The experiments to which you allude were made on the 10th and 11th of October, 1848. The explosion of the retort, which had never been at work at all, took place on the 25th of November, and —— had no more to do with it than you had. I do not wish to interfere in your quarrels, but I cannot suffer such an incorrect statement to be circulated through the country without endeavouring to put the matter right as far as I can.

"I am, dear sir,

"Yours, respectfully,

"C. SMITH."

Correspondence.

ON COAL GAS AS A SOURCE OF HEAT.

SIR,—The use of coal gas as a means of affording heat, has only lately received attention, except in some few cases (such as *gassing* lace, &c.), where its peculiar aptitude for the purpose in view has induced its adoption. As, however, attempts are now being made to apply gas to heating purposes more generally, it is worth while to consider what we may expect from these attempts in an economical point of view; for as on the one hand we ought to be in a position to demonstrate what *can* be done, so on the other we ought carefully to guard against those unwarrantable expectations too often incautiously raised, and which always tend to the serious damage of an otherwise good cause.

I beg therefore to devote a few lines to the question, What quantity of heat can we expect to be given out by a given quantity of gas of a given composition?

Now, in order to have a clear understanding as to the meaning of the terms we employ, we will premise that *quantity* of heat is entirely a different thing from *intensity*, and is estimated in quite a different manner. For example, to heat 1 lb. of mercury from 100 to 200 degrees, requires only $\frac{1}{28}$ the expenditure of fuel as to heat the same weight of water in a like degree. Here, therefore, though the *intensity* is in both cases the same, the *quantity* of heat is different in the proportion of 28 to 1.

The *intensity* of heat is measured directly by the thermometer, but *quantities* of heat are measured by comparing them with a certain known effect of heat upon water; the UNIT OF HEAT being in this country *, *that quantity which will raise 1 lb. of water one degree Fahrenheit.* Thus to raise 1 lb. of water 10 degrees Fahrenheit, or 10 lb. 1 degree Fahrenheit, requires 10 units of heat. To raise 30 lb. of water 45 degrees requires (30 × 45) 1350 units of heat.

Again, it is necessary to bear in mind in discussing questions of this nature, that a quantity of heat, when once obtained, is a definite and unalterable thing; it is not capable of either augmentation or diminution, and the only use which any contrivance or apparatus can serve is, to improve or modify the application of such quantity of heat to the purpose for which it is intended. For example, the perfect combustion of 1 lb. of good coal will generate about 12,000 units of heat; and, supposing the combustion to take place in the furnace of a steam boiler, this quantity of heat will be expended partly in evaporating water, and partly in other ways which are less profitable, such as in rarifying the current in the chimney, in warming the surrounding air, &c. &c.; the only effect of any modifications of the boiler and furnace apparatus will be to induce the application of as much as possible of the heat to the useful, and as little as possible to the useless purposes. Hence, when we can ascertain the quantity of heat any kind of fuel ought to give out in burning, we may rest assured that no modification of apparatus will increase this quantity, but that all that ingenuity can do will be to apply the greatest proportion of it to useful ends. This proposition simply expressed may sound somewhat like a truism, but its application would expose the extravagant performances ascribed to many inventions of the present day.

The quantity of heat given out by the burning of most of the simple combustible elements has been ascertained by chemists with tolerable precision. We need only here trouble ourselves with two, carbon and hydrogen. Despretz has found that 1 lb. of pure carbon will in burning, raise 78·15 lb. of water from freezing to boiling point, which is equivalent to 14,067 units of heat; Dulong makes it 13,268. Similarly, the combustion of 1 lb. of hydrogen will give out about 62,000 units of heat.

These being determined, we may find the calorific value of any known compound of carbon and hydrogen by the following rule:—

Find the quantity of carbon and hydrogen contained respectively in 1 lb. of the given compound, multiply the former by 13,500, and the latter by 62,000; the sum of the products will be the quantity of heat due to the perfect combustion of 1 lb. of the given fuel.

In applying this to coal gas, we may take as examples two kinds of gas, the quantities of olefiant and light carburetted hydrogen in which, are given by Mr. Wright in your Journal of Nov. 10, 1849. Now, olefiant gas consisting of 2 atoms of carbon (weight = 12), and two atoms of hydrogen (=2), 14 parts by weight will contain 12 parts of carbon and 2 of hydrogen; similarly, light carburetted hydrogen consisting of 1 atom of carbon (= 6), and 2 of hydrogen (= 2), 8 parts by weight will contain 6 of carbon and 2 of hydrogen. We can, therefore, resolve the gases into their constituent elements as follows:—

1st. Gas from Newcastle coal, specific gravity, 0·420. The composition of 100 cubic inches of this is stated to be as follows:—

Grains.		Composed of Carbon. Grains.	Hydrogen. Grains.
1·224	Olefiant gas	1·049	0·175
11·142	Light carburetted hydrogen ..	8·357	2·785
·674	Hydrogen		·674
13·040	Total.	9·406	3·634

* In France the unit of heat is the quantity which will raise 1 kilogramme of water one degree centigrade.

Hence 1 lb. of this gas (= 31 cubic feet) will contain $\frac{9{\cdot}405}{13{\cdot}040}$, or 0·72 lb. of carbon, and $\frac{3{\cdot}634}{13{\cdot}040}$, or 0·28 lb. of hydrogen; therefore,

			Units of Heat.
13,500	×	·72	= 9,720
62,000	×	·28	= 17,360
		Due to 1 lb. ..	27,080,

or 1 cubic foot of the gas is capable of evolving 850 units of heat.

2nd. Gas from Scotch cannel coal, specific gravity 0·620; composition of 100 cubic inches, as follows:—

Grains.		Carbon. Grains.	Hydrogen. Grains.
4·28	Olefiant gas	3·67	0·61
14·97	Light carburetted hydrogen ..	11·23	3·74
19·25	Total.	14·90	4·35

Whence at appears that 1 lb. (= 21 cubic feet) of this gas will contain 0·775 lb. of carbon and 0·225 lb. of hydrogen, and the heating power appears as follows:—

			Units of Heat.
13,500	×	0·775	= 10,463
62,000	×	0·225	= 13,950
		Due to 1 lb. ..	24,413

or 1 cubic foot of this gas is capable of producing 1162 units of heat.

These amounts are, therefore, the maximum theoretical quantities of heat which pure gases, of the composition stated, may be expected to give out by perfect combustion, and they define a limit of heating power, which, supposing the correctness of the data, cannot be exceeded. But the quantity of heat actually realized in practice must of necessity fall short of this for many reasons. The gas may not be pure; it may contain water, carbonic oxide, atmospheric air, ammonia, sulphuretted hydrogen, carbonic acid, &c., any of which would, *pro tanto*, diminish its heating power; the combustion may be imperfect; a portion of the heat evolved may be carried off by the products of combustion; other portions may be absorbed by the apparatus, or communicated to the air and other surrounding objects by radiation, conduction, &c. For all these reasons we ought not to expect to obtain in practice results so high as those above-named.

We have yet very few experiments on this subject. It is recorded in your last number, p. 327, that Mr. G. H. Palmer found that one foot of coal gas consumed, raised one foot of air 20,000 degrees Fahrenheit, which is equivalent to raising 1 lb. (13 feet) 1538 degrees. But to heat 1 lb. of air 1 degree requires 0.267 units of heat, whence the quantity realized by Mr. Palmer is 410 units. This is only half the heat due to Newcastle coal gas, and little more than one-third of that from cannel coal.

I have been allowed to mention that some careful experiments now in progress by a gentleman of great experience and skill in all matters connected with gas, and which will, in all probability, soon be made public, have given a much higher realized amount of heat than Mr. Palmer's, and appear to corroborate tolerably well the results arrived at by calculation.

The only other experimental result I know is that given by Mr. Edwards in your last number, already quoted, where he states that, with the aid of his "atmopyre," he can make one foot of gas evaporate 1 lb. of water, which (supposing the water previously raised to boiling point) is equivalent to 988 units of heat. This appears to exceed the calorific power of Newcastle coal gas, and it is, therefore, to be wished that Mr. Edwards would publish the details of the experiments on which his result is founded. I fear he expects too much from his apparatus.

Supposing it possible, by good arrangements, to get 700 or 800 units of heat practically applied by the consumption of one foot of gas, we shall have as the result, that about 12 cubic feet of gas are equivalent in practical calorific value, to 1 lb. of good coal, as burnt under the best steam-engine boilers. It must be remembered, however, that many heating operations involve a *waste* of coal, while with gas little or no waste need be caused. Cooking is a case in point.

I venture to suggest the heat-giving powers of gas as a good subject for experimental research, for, although it may not always compete with other fuels in price, yet, as there are many situations where its use would offer obvious and manifold advantages in point of convenience, it is highly desirable that its capabilities in this respect should be made known to the world. AN ENGINEER.

London, Nov. 27, 1850.

Register of New Patents.

HORATIO CARTER, of Thirza-place, Old Kent-road, in the county of Surrey, gentleman, for "*certain improvements in the production of light from ordinary coal gas by the use of burners consisting of more than one ring or sheet of flame combined with a suitable chimney, and supplied with atmospheric air, adapted also to ventilation.*" Patent dated March 23, 1850.

The principle of this invention is first, the construction of gas burners with as many flames in the same plane and concentric to each other, as its size will permit (consistent with a due supply of air on both sides of each ring of flame), whereby the entire combustion of the gas is ensured, though the air admitted is not sufficient to cool or lower the temperature of the flame; secondly, receiving this compound flame into a chimney, whose diameter at the mouth shall be more or less reduced, in proportion to the diameter of the flame, by which the ascending current of air is brought to bear on and compress the flame, this point of contraction being at such height above the burner as to produce a bright and steady flame; thirdly, carrying off the products of combustion from the burner, together with the application of the waste heat carried off by such burners to the purposes of ventilation. In the concentric gas burner hitherto used, the object has been simply to obtain the effect of two or more concentric flames, without having due regard to the proper and uniform supply of air to each flame. The consequence of this is that great and unnecessary quantities of air enter such burners, resulting in the flame being cooled much below the temperature requisite for the perfect combustion of the gas, while the light itself is from the same cause of less intensity than it would be were the due proportions of air and gas supplied to the burner. These improved burners are calculated for the combustion or ordinary coal gas, slight variation being required when gas of greater or less purity is consumed—such as having the jet-holes more numerous, and of smaller diameter, or less numerous, and of larger diameter—without, however, varying to any extent the proportions between the area of the gas jets and the air passages in the aggregate. It may be remarked that in the following description, the patentee supposes the gas jets to be limited in the supply of gas only to such an extent as will produce the proper length of flame for the burner, otherwise the supply of gas will be too great for the air admitted, or the supply of air too great for the gas. In practice, the patentee finds that for the diameters of the jet-holes, 1-32nd part of an inch is well adapted for the combustion of ordinary gas; these are drilled at distances of 1-11th of an inch round the burner, for the production of a ring of flame. For these holes, the space between two concentric rings should be one quarter of an inch—that is to say, a difference of half an inch between the inner diameter of the larger ring, and the outer diameter of the inner or smaller ring; this proportion of the air space being about fifteen times greater than the aggregate amount of the two rings of jets, and which supplies the inner diameter of the larger flame, and the outer diameter of the smaller flame, while the interior of the smaller flame is limited to a

Fig. 1.

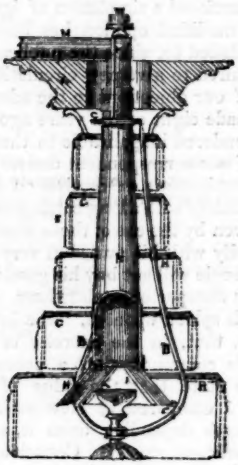

Fig. 2.

like proportion, as exemplified in the engravings. Fig. 1 represents a cut glass chandelier, illuminated according to this invention; and fig. 2 a vertical section of the same. In illuminating rooms and places where the light is required to be generally diffused, the patentee prefers surrounding the burner with cut glass drops, which, by their refractive and reflective powers, serve to heighten the effect, and also to soften and diffuse, without detracting from the brilliancy of the light. This description of chandelier also serves to maintain the air surrounding the burner at a uniform heat, thereby protecting the glass chimneys from fracture, to which they are liable from sudden changes of temperature. A, A, is the burner, which is a three-ring

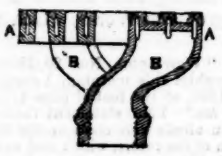

Fig. 3.

Fig. 4.

concentric burner, represented of a larger size at figs. 3 and 4. These rings, *a*, *a*, *a*, have three supply channels in the arms, *b*, *b*, *b*, in order

to ensure a uniform supply of gas. The burner, A, is supported in a triple pendent, B, B, B, depending from the ceiling of a room or other suitable position. The upper part of the pendent terminates in a ring, C, supported by two branch pipes, D, D, from a ball and socket, E, through which the supply of gas is admitted. The glass drops, F, F, F, are supported by rings, G, G, G, G, from pendent arms, B, B, B, by brackets, H, H,—these drops are sufficiently close to prevent any concentrated rays passing beyond the chandelier. The burner, A, A, is surrounded by a conical deflector, I, I, by which the air to the exterior of the burner is unlimited. This cone, I, is sustained at the base by brackets, *c*, *c*, *c*, and received at the top by a ring or gallery, *d*, *d*, which sustains the chimney, K. The junction of the deflector, I, and chimney, K, should be sufficiently close to prevent the admission of cold, or egress of heated air. The chimney, K, for chandeliers, the patentee prefers of ground glass, with a transparent cone, I, of clear glass, so that it may transmit the direct rays, and also act to a greater or less extent as a reflector, to throw the light directly downwards. To produce the perfect combustion of the gas, the flame is compressed or contracted, by causing the whole to pass through an opening of less diameter than the larger flame. In order to effect this, where glass chimneys are used, an annular piece of talc, L, or other material (by preference transparent) is introduced, capable of withstanding the heat to which it is exposed. This ring of talc, L, for the contraction and compression of the flame, is situate in all cases at the top of the flame, in contradistinction to similar deflectors, hitherto used at or near the lower part of gas flames. The talc, L, is placed at a height of two and a quarter inches from the burner, and the opening in the centre, forming the passage for the products of combustion, is two and a half inches in diameter, while the diameter of the larger ring, *a*, at the jets is three inches, so that the difference between the diameter and the flame at the burner and the internal diameter of the talc ring, will be half an inch, in addition to which the flame will be further contracted by the passage of the air on the exterior of the flame, producing a compression of the entire flame, in accordance with ascending currents of air entering within, and on the exterior of, the burners. This compression of the flame is variable in burners of different diameters, as, for instance, in the smaller burners, say for one and a quarter or one and a half inches, the passage of the air will produce sufficient compression through a space contracted to the same diameter as the burners, whereas in large burners of seven or eight inches diameter, the interior diameter of the contractor or deflector of the chimney may be one and a half or two inches less than the burner. The chimney, as before mentioned, is of ground glass, and of larger diameter than the opening in the talc, in order to prevent the heat injuriously affecting the glass; but where the chimney is of metal, or other material not affected by the heat, the lower end of such chimney may form the necessary contraction, and may be continued throughout of a like diameter. The chimney, K, is continued upwards, and received within a tube composed of metal, earthenware, glass, or other suitable material, M, passing through the ceiling, N. By the tube, M, the products of combustion are conveyed away to a chimney, or other suitable exit, properly trapped by a cowl, or otherwise, to prevent downward currents; by this means the whole of the products of combustion are carried off from the burner. Lights may thus be placed in a chandelier of cut glass, instead of placing the lights on the exterior of such chandeliers, as hitherto practised. In the engraving annexed, the chandelier is represented as carried quite up to the ceiling, in order to conceal the chimney; it may, however, be suspended at a greater or less distance from the ceiling, and the chimney continued of glass, metal, earthenware, or other material rendered more or less ornamental for the purpose. In positions where it is unnecessary to carry off the products of combustion, as in the open air or in large rooms where such products will be carried off by the ordinary ventilation, it will be sufficient if the chimney is carried above the chandelier, and to prevent the heat injuriously acting thereon, it should be of a length sufficient to ensure the necessary draught to produce perfect combustion of the gas. This chandelier is also adapted for the purposes of ventilation either by simply carrying off the air through the burner, or, in addition thereto, to employ the heat passing off by the pipe, M, for the rarefaction of air in an ascending tube or chimney. For this purpose the patentee encloses the pipe, M, within another tube, of sufficient area to give the necessary amount of passage. This outer tube opens near the chandelier, or in any other part of the room, near the ceiling by a covered perforated or other suitably ornamented surface. The tubes are continued in their relative positions towards the point of escape, which is at such an elevation above the room, that the rarefaction of the air in the outer tube will have sufficient ascending power to carry off the vitiated air and ensure the necessary ventilation. In lieu of the outer tube, an ordinary chimney may be made available for the purpose. Reverting to gas burners, the patentee shows in figs. 3, 4, 5, 6, 7, and 8, a number of burners of different sizes, constructed according to his invention, adapted for lights either surrounded by a chandelier, or simply by a chimney. It has been before stated that an air space a quarter of an inch between the burners is the best proportion for the size and number of the gas jets, allowing one quarter of an inch for the thickness of metal. The concentric rings of burners increase by consecutive inches, as represented at figs. 3 and 4, where the first or smallest ring is one inch, the second, two inches, the third, three inches, and so on. In burners three inches and upwards, three branches, *b*, *b*, *b*, are employed for the supply of the gas, at three equi-distant points of the ring; in order to ensure the regular supply of gas, the rings, *a*, *a*, *a*, are let into the branches, *b*, *b*, with free passage on the under side for the gas. The jets immediately above the branches, *b*, *b*, *b*, should be rather smaller than the others, in order to counteract the additional tendency of the gas to escape at those points. The space between the rings, *a*, *a*, are increased in width towards the lower side, so that no limitation of the space takes place beyond the proper area by the introduction of the arms, *b*, *b*. For very large burners, in addition to the three supply branches, the patentee connects the several rings by intermediate pipes, in order to equalize the supply. Fig. 5 is an elevation of a three-flame burner,

Fig. 7.

Fig. 8.

Fig. 5.

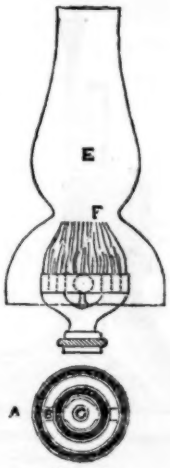

Fig. 6.

and fig. 6 a plan thereof; it is furnished with a chimney, *e*, adapted for the contraction of the flame at the proper point, *f*, as the flame only extends to the point of contraction which, in this instance, is two inches above the burner; the whole of the upper part may be ground, while the lower part surrounding the flame is transparent. The inner ring, *a*, of this burner, is one and a quarter inches in diameter, and in order, therefore, to reduce the interior space, the patentee places a jet in the centre, with a plug, *g*, 9-16ths of an inch in diameter, thereby limiting the supply of air to the proper proportion for the interior of the flame. In this burner, as well as all others, the supply of air to the exterior of the burner is unlimited, otherwise than by the size of the lower and contracted part of the chimney, which, in this instance, is one quarter of an inch less than the larger flame. Short chimneys do not require the introduction of a talc ring, as the heat evolved is not so intense as to injure the glass. Fig. 7 is an elevation, and fig. 8 a plan of a two-flame burner, with a glass chimney, *e*, of somewhat different construction, but with the necessary contraction, *f*, situated as before-mentioned. This burner, *a*, *a*, which is one inch and $\frac{1}{8}$th in diameter, has the centre space limited by a $\frac{3}{4}$th plug, *g*, having a jet in the centre. Instead of a single jet in the centre, a circle of four or five small jets may be substituted, to consume the superabundant supply of air to the interior of the burner.

The patentee claims:—

First.—The construction of concentric gas burners before described, whereby the supply of air to the interior of such burners is regulated, so that an approximation to the exact proportion necessary for the entire combustion of the gas is admitted to the flame, such burners being combined with a chimney and deflector, in the manner and for the purposes described.

Secondly.—Illuminating by means of a cut glass chandelier, surrounding or enveloping a gas light, as hereinbefore described.

Lastly.—The mode of ventilating rooms or apartments, by means of the heat from gas burners, as described.

Richard Laming, of the new chemical works, Isle of Dogs, Middlesex, chemist, and Frederick John Evans, of the Horseferry-road, Westminster, gas engineer, for "*improvements in the manufacture of gas for illumination and other purposes to which coal gas is applicable, in preparing materials to be employed in such manufacture, and in apparatus for manufacturing and using gas; also improvements in treating certain products resulting from the distillation of coal; parts of which above mentioned improvements are applicable to other similar purposes.*" Patent dated April 23, 1850.

SPECIFICATION.

One part of our invention is an improvement in retorts for making gas and other purposes in melting-pots, crucibles, muffles, stoves, firebricks, and lumps and other articles of clay required to stand the action of fire without cracking. The improvement consists in mixing with the fire clay, which is to enter into the composition of any of the aforesaid articles, about 0·25 per cent. of its weight of asbestos or fibrous silicate of magnesia; the vessels are then to be constructed and burned in the manner understood by artisans engaged in the various branches of the art. We do not confine ourselves to any particular forms of the articles, and each may be made of one or more pieces as at present; the proportion of the silicate of magnesia may be varied to meet the exigencies of particular cases, its introduction being for the purpose of giving greater tenacity to the materials used, and thus diminish their aptitude to become cracked under the influence of change of temperature.

We claim under this head of our invention the introduction of asbestos or fibrous silicate of magnesia among the materials used for making articles of clay intended to be submitted to a great heat; and the use of all such articles made with asbestos or fibrous silicate of magnesia in their composition.

Another part of our invention is a particular arrangement of apparatus for making gas from oil, tar, melted pitch, resin, fat, or other

analogous material in conjunction or not with water. This arrangement of apparatus will be understood by referring to the accomanying drawing, in which fig. 1 is a retort in iron or clay, composed of two chambers, A and B, and which are closed by three man-hole doors, C, C, C, two of them in front, and one larger at the back, all three projecting beyond the brickwork setting. D, D is a funnel of large diameter, closed by a cover, E, either dropping into an hydraulic joint filled with metal fusible at the temperature to which it is exposed, or by screwing in any ordinary manner of man-hole doors. The cover, E, is fitted with a double syphon, F, governed by a stop cock. G is the eduction pipe conducting to the hydraulic main. To use this apparatus previously raised to the usual temperature, we charge the chamber, B, with coke, heaping it somewhat at the part marked B, fig. 1, and allowing some pieces to fall over against the large man-hole door at the back. We charge the chamber, A, either with coal or coke. We introduce a stream regulated by the stopcock of oil, tar, melted pitch, resin, fat, or other analogous matter, in conjunction with water or not, by the double syphon, F, and the large funnel, D, D, causing it to fall upon the red hot coke at B, and to pass thence partly as gas and partly as liquid, through the upper chamber to the back of the lower one, along which it next passes chiefly in the state of gas to escape, mixed with the gaseous products of the chamber, A, by the eduction pipe, G, into the hydraulic main. When we charge the lower chamber of this apparatus with coal, we prefer not to let in the liquid which enters by the double syphon, until the coal has had time to give off great part of its richer gas, and to become heated throughout; but when we use coke in both chambers, we let in the liquid from the commencement and without intermission, until the passages of the gas need to be opened and cleaned out. The operation of cleaning which is so frequent and difficult with other forms of apparatus as to prevent their successful employment, is with our invention both easy and comparatively unfrequent.

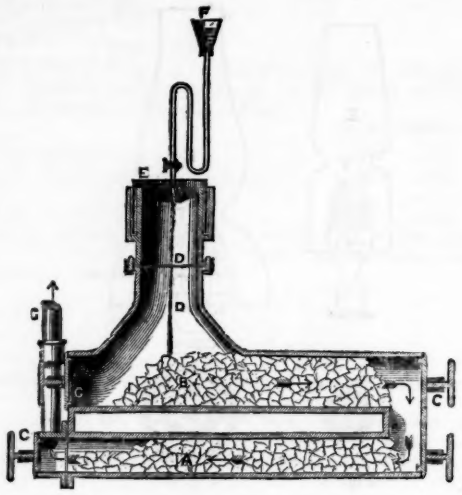

Fig. 1.

We do not claim the making of gas from tar, or any other form of hydrocarbon or water by means of red hot coke, or the combining of any materials for affording gas; what we claim under this head of our invention, is the combination and arrangement of apparatus, particularly of the large funnel, marked D, D, with the double chambers and back and front man-hole doors, for making gas by the decomposition of any suitable hydrocarbon or water, by bringing it in a fluid state into contact with red hot coke or other suitable material.

Another part of our invention consists in elongating the eduction pipes of retorts used for making gas for illumination into their interior, and arranging them in lines near their axis. We leave the farther ends of these pipes open, and support them on a bearer. Holes should be made along the pipes only in sufficient number to permit of the free escape of the gas as it is generated; but what is better, is to leave a longitudinal slit at the under side of the horizontal pipe from its further end to near its ascending portion, as this arrangement admits of the passage being cleared out by a proper tool in event of its becoming choked. The improvement is applicable to retorts of the ordinary forms and of any material, but we find it more easy to charge them where this invention is adopted when they are made wide enough to receive a charging scoop on either side of the horizontal eduction pipes. The object of our improvement is to diminish the contact of the gas with a surface heated high enough to cause it to deposit some portion of its carbon; and thus to produce a richer gas, or a larger quantity of equally rich gas from a given quantity of coal.

Under this head we claim the elongation of the eduction pipes of retorts used for making gas for illumination along or near their axes.

Another part of our invention is a process for obtaining light by means of platinum heated to whiteness by coal gas or peat gas. It is known that when water is decomposed and the resulting hydrogen burnt within a small cage made of platinum wire, or platinum foil, in such a manner as to heat the metal to whiteness the platinum becomes luminous, and remains so so long as its temperature is maintained; but it is equally well known that hydrogen gas resulting from the decomposition of water is not readily obtainable under the generality of circumstances where light is required. Our improvement consists in replacing hydrogen gas from water by the coal gas, which is to be obtained almost universally, and which answers the purpose, or by peat gas. For putting our improvement into operation we prefer to burn the gas either by itself or mixed with atmospheric air within a cylinder greater in height and diameter, and made of platinum wire more coarse as the quantity of gas burned within it in a given time is greater, the only practical rule that it is necessary to give being that all the metal be placed with respect to the flame in the best position for becoming white hot. The advantages which result from this part of our invention are, first, with respect to ordinary coal gas, that we obtain more light in proportion to the quantity of coal gas consumed than in the case where platinum is not used; and, secondly, that by its means we obtain a good light by the combustion of peat gas, or of coal gas of inferior quality.

Under this head we neither claim nor restrict ourselves to the use of any particular form or dimensions of the platinum apparatus; what we claim is, the use of coal or peat gas, mixed or not with air, for heating platinum wire or foil to whiteness, and thereby producing light.

A former patent has conferred on one of us the exclusive right to purify coal gas by a solution of muriate of iron mixed with porous materials, and also by muriate of iron decomposed by lime into chloride of calcium and oxide of iron, and made porous by suitable materials. One part of the present invention consists in combining known processes so as to obtain the last-named purifying materials. We decompose sulphate of iron in solution by its equivalent quantity of chloride of sodium, and having separated by known means the resulting sulphate of soda, we add to the solution of muriate of iron concentrated by evaporation first enough dry sawdust or other suitable matter to absorb it, and then enough hydrate of lime to decompose it into chloride of calcium and precipitated oxide of iron. We purify coal gas with this mixture disposed in dry purifyers, and afterwards extract from the used materials by any ordinary processes adapted for that purpose, sulphur, cyanogen, and muriate of ammonia. Sometimes we modify the purifying material in the following manner:— We mix equivalent quantities of ground or granulated sulphate of iron or chloride of sodium with the other of these salts in solution absorbed into sawdust or other suitable matter, and then stir in an equivalent of hydrate of lime. This modified material, used in dry purifyers for purifying coal gas, subsequently affords by lixiviation a mixed solution of sulphate of soda and muriate of ammonia, and sulphur and cyanogen also may be extracted from it as in the former case. We also sometimes replace sulphate of iron by sulphate of copper, when the resulting oxide of course is the oxide of that metal instead of the oxide of iron.

We claim under this head the combination of processes above described for making a purifying material containing chloride of calcium and precipitated oxide of iron or copper; and we claim the composition of the modified material as described. We claim also the use of both kinds of materials for purifying coal gas.

Another part of our invention consists in purifying coal gas by means of a cheap material made by mixing refuse sulphate of lime or gypsum in a finely divided state with sulphate of iron. The sulphate of iron should be either ground fine or granulated, and mixed with sawdust or other matter suitable for separating its particles, or it may be merely mixed in a divided state with the earthy salt, or absorbed into its mass or into sawdust or other porous matter. The gypsum should be previously baked at a red heat to prevent its tendency to solidify with water. We use the material thus prepared in dry purifiers in the way well understood for purifying by hydrate of lime. For the sulphate of iron other metallic salts may be substituted with similar results; such, for example, as muriate of iron, sulphate or muriate of zinc, sulphate or muriate of manganese, or even sulphate or muriate of copper; but we prefer sulphate of iron. We either make use of the resulting mass as a manure, or we subject it to certain known chemical processes for obtaining from it an ammoniacal salt, or salts, sulphur, and cyanogen.

We claim under this head the purification of coal gas by the use of sulphate of lime mixed with any of the metallic salts above named, and the use of the spent purifying material as a manure.

Another part of our invention is the causing of impure coal gas to pass through dry purifiers charged with a porous solid material which we make by mixing in about equivalent proportions hydrated or precipitated oxide of iron with carbonate of lime, magnesia, carbonate of magnesia, or magnesian limestone in fine powder, or else burned and slaked either by themselves or rendered more pervious to the gas by sawdust or other suitable matter. A mixture of precipitated oxide of iron and lime answers the same purpose, and was claimed by one of us under a former patent. In each of the above cases oxide of copper may be substituted for the oxide of iron. All the several compounds when they begin to act on the impure gas purify it from sulphuretted hydrogen and cyanogen, and having been once made foul, and afterwards placed in contact with atmospheric air for a few hours, any one of them acquires the property of purifying coal gas from ammonia also. The spent materials afford, by processes well known, cyanogen, sulphur, and ammoniacal products.

We claim under this head the purification of coal gas by mixtures made as described, whether with hydrated or precipitated oxide of iron or of copper.

Another part of our invention consists in a particular way of using chloride of magnesium or sulphate of magnesia for withdrawing from coal gas ammonia and carbonic acid. We take sawdust or other solid matter calculated to expose an extensive surface to the gas without opposing great resistance to its passage, and we cause it to absorb a saturated solution of one or both of the above-named salts, or we mix those salts singly or together in a divided and solid state with sawdust or other suitable matter made damp, and then place the mixture in dry purifiers, through which we make the gas pass in its way from the condensers to the gasholders. When the gas ceases to

JOURNAL OF GAS LIGHTING

be purified from its ammonia, we take out the contents of the purifier and wash them to obtain an ammoniacal solution, and supply their place by a new charge of similar purifying materials.

We claim under this head the extraction of ammonia and carbonic acid from coal gas by chloride of magnesium, or sulphate of magnesia and water diffused through sawdust or other solid matter capable of exposing an extensive surface of the reagents to the gas without materially impeding its passage.

Another part of our invention consists in purifying coal gas by the use of a solid material containing chloride of magnesium, or of calcium or sulphate of magnesia mixed with hydrated or precipitated oxide of copper. To make this purifying material we take sawdust or other suitable matter wetted with a strong solution of muriate or sulphate of copper, or else either of those salts of copper in a finely divided state and mixed with moistened sawdust or other suitable matter, and we mix with it enough lime, magnesia, or its carbonate or magnesian limestone burned and slaked with water, or powdered to decompose the salt of copper into precipitated oxide of the metal, and a salt of lime or magnesia, or both. Or instead of making extemporaneously both or either of the salts of magnesia and lime and oxide of copper, we mix sulphate of magnesia, or chloride of magnesium, or of calcium ready formed and in a state of mechanical division or in solution, with oxide of copper and sawdust or other suitable matter. We use these purifying materials in dry purifiers like hydrate of lime. They can remove from the gas ammonia, carbonic acid, and sulphuretted hydrogen, or they may be used for the latter impurity without the two former. In the first case we find it useful to add to them about half an equivalent of fine carbonate of lime or of carbonate of magnesia or of both; and in the latter case we prefer to make either the same addition, or in lieu thereof we add about the same quantity of caustic lime or magnesia, or of both of them. When the used material will no longer purify the gas from sulphuretted hydrogen, we either take it out from the purifier and expose it to the atmosphere, or direct a current of air through it while in that vessel, opening or not at the same time a vent hole in the purifier below the level of the foul purifying matter. We thus restore to the material its purifying energy, and this alternate expenditure and restoration of energy we can repeat a number of times until the material becomes sufficiently charged with sulphur and with ammoniacal and cyanogen products, or either of them, to render it worth while to extract it or them in any known way.

We claim under this head the purifying coal gas by the repeated use of a solid material containing sulphate of magnesia, or chloride of magnesium, or calcium, or more than one of those reagents in combination with oxide of copper, and mixed or not with lime or magnesia, or both, or either, or both of the carbonates of those earths.

Another part of our invention is a process for converting the ammoniacal liquor produced in making gas or by distilling animal matters into sulphate of ammonia. By repeatedly using the same portion of hydrated or precipitated oxide of iron or copper in conjunction with lime or magnesia, carbonate of lime, or carbonate of magnesia, or any compound of lime or magnesia susceptible under the circumstances in which it is used, of being decomposed by carbonate of ammonia for purifying coal gas, with subsequent exposure to atmospheric air, the spent material eventually becomes in great part changed into sulphate of lime or sulphate of magnesia, mixed with oxide of a metal. When this has taken place, we mix the spent material in a vat for an hour or two, with nearly as much of the ammoniacal liquor as it will decompose; we next draw off the fluid; we filter it; we perfect the saturation of any ammonia which it may contain in a volatile state by sulphuric acid, and then we evaporate it to obtain crystals of ammoniacal sulphate. The same process is followed by another good result, for the decomposition of the carbonate of ammonia by the sulphate of lime or sulphate of magnesia, reproduces in the spent material a carbonate of the earth, which fits it for beginning anew the work of purifying coal gas.

We claim, under this head, the use of the spent materials above-described for converting solutions of carbonate of ammonia, mixed or not with hydrosulphate of ammonia, into solutions of ammoniacal sulphate, by which use we also change the sulphate of lime or sulphate of magnesia in the said mixtures into carbonate of lime or carbonate of magnesia.

When solid and porous mixtures, containing hydrated or precipitated oxide of iron or copper, or a salt of either of those metals decomposable into hydrosulphate of the metal under the circumstances in which it is used, is employed to absorb sulphuretted hydrogen from coal gas, and afterwards placed in contact with atmospheric air, the mixture rapidly absorbs oxygen, and thereby acquires an elevated temperature, greater in proportion as it is free from moisture. In certain cases when the materials are at first, or become by use, dry to the touch, their temperature during the subsequent absorption of oxygen rises much higher than is desirable; one way of preventing this injurious accession of heat is by communicating humidity to the mixture of materials at a proper time, and constitutes another part of our invention. We put this improvement into practice either by sprinkling the used purifying materials with water on removing the cover from the vessel which contains them, or by pipes properly disposed within the vessel to distribute water over the surfaces of the materials without removing the cover, or by sprinkling the materials with water after they have been thrown out of the vessel, or, lastly, by placing the purifier in communication with a steam boiler, and directing through the used materials a sufficient quantity of the vapour of water to moistem them; and subsequently submitting them to the influence of a current of atmospheric air, also directed through them. We know it to be necessary that the metallic oxides used for purifying coal gas from sulphuretted oxygen should be hydrated, that is to say, combined with a certain proportion of water in a dry state; but our experience teaches us, contrary to common opinion, that the said oxides act less energetically on the sulphuretted hydrogen in the gas, and also that they regain their expended energy less suddenly when they contain water in a liquid state, than when they are free from hygrometric water.

Under this head of our invention we do not claim the regeneration of the purifying energy of any spent purifying mixtures by exposing them to atmospheric air; what we claim is, the means we have described for checking the rapidity of the regenerating action and consequently preventing the temperature of the materials from rising to a pernicious height, namely, by wetting them with water, or by condensing steam in their mass, either in or out of the purifier at any time after they commence to purify the gas, and before they be put in communication with the atmosphere.

Experience has proved to us that mixtures containing hydrated or precipitated oxide of iron changed into hydrosulphuret of iron, by purifying coal gas from sulphuretted hydrogen, do not readily reabsorb oxygen, and consequently do not readily recover their purifying energy at temperatures below 32 degrees Fahr. Another part of our invention consists in applying to such used mixtures, during frosty weather, atmospheric air, artificially warmed to about 60 degrees Fahr., by the ordinary operations of the "retort house," or in any other convenient manner. The warmed air may be used there, or conducted thence to the purifiers by suitable pipes, in which a draught is established by any known means.

We claim under this head the use of air, artificially warmed, for promoting in cold weather the regeneration of hydrated oxide of iron in mixtures which have been used for purifying coal gas from sulphuretted hydrogen, whether the warmed air be conveyed to the used purifying mixtures, or the latter be carried to the warm air.

Another part of our invention is the use of phosphate of lime, dissolved in hydrocloric acid, for purifying coal gas, and for decomposing the ammoniacal liquors produced in making gas, and in the distillation of animal matters, and the application of the products as manures. To put our improvement into practice, we dissolve bones or other forms of phosphate of lime in hydrochloric acid. We prepare this solution for purifying gas by mixing it with sawdust or other suitable solid matter, and then we expose it to the impure gas in dry purifiers. To use the solution for decomposing ammoniacal liquors, we add one of the fluids to the other until the hydrosulphuric and carbonic acids, combined with the ammonia, have escaped. To facilitate the transport of the product, and its application as a manure, we heat it in pans until it becomes dry. The product of the purification of gas is also a good manure, mixed as it is with the sawdust, or other absorbent matter used.

We claim under this head the use of a solution of phosphate of lime in hydrochloric acid for purifying coal gas, and for saturating ammoniacal solutions; and we claim also the use of the products as manures.

Another part of our invention is certain processes for obtaining, in an economical manner, one of the reagents which we use for purifying gas—namely, chloride of calcium. In certain chemical works hydrochloric acid gas is a residuary product not only of no value, but even costly to get rid of without nuisance to the neighbourhood. One of our processes consists in causing hydrochloric acid gas to pass in a heated state over beds of lime, or carbonate of lime, in its way from the furnaces where it is generated to the condensers, where it would else become absorbed into water. We construct our beds of lime, or carbonate of lime, on the bottoms of the ordinary conduits, arranging two conduits in a line, and working and discharging them alternately. When the lime in one passage has become converted into chloride, the draught through it is turned into the neighbouring passage by means of dampers arranged for that purpose, and the finished charge withdrawn by doors made at convenient distances. When this is done the bed is recharged with lime, or its carbonate, in readiness to receive the current of hydrochloric acid after it shall have saturated the lime in the second conduit. When this saturation is completed the dampers are reversed, so as to direct the acid gas again into the first conduit, while the charge of the second is being withdrawn by its doors, preparatory to recharging it a second time, and thus continually. By our second process we obtain hydrochloric acid in a concentrated state, preparatory to its saturation in a fluid form by lime or its carbonate, or to its application to other uses. For this purpose we work with only one conduit leading from the furnaces where the hydrochloric acid is generated. We line this conduit by glazed bricks, or tiles, or sandstone, and so construct its bottom that any fluid formed within it shall escape by a pipe adjusted to its lowest part. We arrange in a line or lines along this conduit a number of porous earthenware vessels, standing on its floor and built into its arch or cover up to their necks. We fill these vessels with water, and make them communicate by means of syphons with one another, and with a reservoir of water placed with its highest part on the same level at the mouths of the earthenware vessels. By well known arrangements we keep the water at a constant level also in the earthenware vessels which communicate with it. The consequences of this arrangement are that the water contained in the vessels within the heated conduit is speedily raised to a temperature of 212 degrees Fahrenheit, and that the gaseous contents of the conduit are reduced to that temperature, or nearly so, and that the water which exudes through the porous earthenware absorbs as much hydrochloric acid gas as it can combine with. Now, as strong hydrochloric acid is condensible at a temperature above 212 degrees Fahrenheit, and as the vapour of water is not condensible at that temperature, the strong acid flows down the outsides of the porous vessels, and runs in a stream to the most depending part of the passage, where it escapes by the pipe placed for that purpose. By treating the acid so obtained with lime or its carbonate we obtain chloride of calcium, or muriate of lime, with hardly any cost for evaporation.

We claim under this head making chloride of calcium by causing the hydrochloric acid gas, which results from the decomposition of common salt by sulphuric acid, to act on lime or carbonate of lime on its passage from the furnace where the decomposition is effected. And also the collecting of concentrated hydrochloric acid for making chlo-

ride of calcium, or other purposes, by condensing hydrochloric acid gas in water by means of earthen vessels built into a conduit or flue conducting from furnaces in which chloride of sodium is decomposed by sulphuric acid, and containing water kept at about 212 degrees Fahrenheit by the heated products of the said furnaces.

Another part of our invention is a new way of using certain forms of carbon for purifying coal gas, and obtaining ammonia therefrom. It consists in causing the material alternately to absorb impurities from the gas, and to discharge them under the influence either of heat or of a current of air or steam directed through the purifying material. To put this part of our invention into practice, we fill a dry lime purifier, or other convenient vessel, with animal charcoal in coarse powder, and direct impure coal gas through it until it no longer issues from the vessel pure. We then send the gas in another direction, and turn through the foul material a current of steam or air, heated or otherwise, receiving the volatile products into any desirable acid or other substance calculated to fix the ammonia, or else condensing the ammonia combined with carbonic and hydrosulphuric acids, by water or by the abstracting of heat in any suitable apparatus. If steam be used, it brings away with it nearly the whole of the ammonia, but it damps the purifying material, which then needs to be dried by a current of hot air or otherwise in the first instance to bring away the ammonia; if air be used, part of it becomes sulphate of that base, and must be removed by washing. In addition to, or without the introduction of, air or steam among the purifying material, it may be heated by steam or hot water contained in a jacket around the vessel, or in pipes within it, or the foul material may be removed from the purifier, and heated to about 212 deg. Fahr., in any close vessel adapted for that purpose. Coke, wood charcoal, or peat charcoal may be substituted for animal charcoal in the process above described, but with inferior results.

We do not claim under this head the exclusive use of any form of carbon for absorbing the impurities of coal gas, our claim being for the means we have described for making coke and charcoal repeatedly useful for purifying coal gas, and for obtaining its ammonia by their agency.

Another part of our invention consists of certain processes by which we obtain prussiate of potash, prussiate of soda, and prussiate of ammonia from prussiate of lime. With respect to prussiate of potash, our process is to mix well together equivalent quantities of prussiate of lime and sulphate of potash, or carbonate of potash previously dissolved in separate portions of water, and then after subsidence of the sulphate or carbonate of lime which forms, to evaporate and crystallize the clear solution. We make the prussiates of soda and of ammonia in like manner, by substituting the sulphates or carbonates of the respective bases for the sulphate or carbonate of potash.

We claim under this head the manufacture of the prussiates of potash, soda, and ammonia, by decomposing solutions of the sulphates or carbonates of those bases by solutions of prussiates of lime.

Another part of our invention is a process for obtaining carbonic acid gas for converting the hydrosulphate of ammonia in gas liquor into carbonate of ammonia, and for other useful purposes to which carbonic acid is applicable. It is known that hydrosulphate of ammonia is decomposable by carbonic acid, and that hydrosulphate of ammonia exists in gas liquor. To change it into carbonate of ammonia, we proceed as follows:—We make a mixture of dentoxide of copper and charcoal, or other form of carbon, in fine powder, in the proportion of twelve parts by weight of the former to one part of the latter, and introduce the mixture into a retort made red hot, and furnished with an eduction pipe passing through cold water, and finally plunging into gas liquor. The formation of carbonic acid gas soon takes place by the union of the carbon with the oxygen of the metal, and combining with the base of the hydrosulphate of ammonia contained in the gas liquor, converts it into carbonate, causing the hydrosulphuric acid to escape. When the carbonic acid gas ceases to come away, nearly all the carbon will have disappeared from the retort, and the copper which it contains become reduced to the metallic state; we then draw the charge, and leave it to become cold, while a second charge of similar materials is being worked off, during which time the copper reabsorbs oxygen from the air, and becomes again dentoxide of copper, which may then be used anew with fresh carbon.

We claim under this head making carbonic acid gas for converting hydrosulphate of ammonia into carbonate of ammonia, and for all other purposes in the arts, by exposing a proper mixture of dentoxide of copper and carbon in powder to a red heat in suitable vessels.

Another part of our invention is a process for consolidating peat to be used in furnishing gas or charcoal or for fuel. Our process is as follows:—Without previously drying the peat, we treat it with water by a mill in a way similar to that in which chalk is treated for the manufacture of whitening, and which is well understood. The resulting liquor is made to pass through a strainer of wirework, fine enough to prevent the passage of the large fibres, into tanks or backs cut in the earth or built upon the surface of the ground if necessary, and where it is left to deposit the finer parts of the peat. When this is effected the supernatant liquor is run off from the deposit, and the magma taken out from the tanks or backs and dried either by the air, by the sun, or on arches of bricks or other absorbent material heated by flues underneath.

We claim under this head the separation of the grosser from the finer parts of peat, and the consolidation of the latter by the process above described.

GEORGE MICHIELS, of London, gentleman, "*for improvements in treating coal, and in the manufacture of gas, and also in apparatus for burning gas.*" Patent dated April 30, 1850.

The subject matter of this specification is divided into three parts, the first of which relates to the preparation or treatment of various kinds of coal for the production of three marketable articles: coke, sulphate of ammonia, and light liquid hydro-carburets.

Secondly—Improvements in the manufacture of gas, for light and fire.

Thirdly—Improvements in the burning of gas, and in regulating its flow through the passages.

Under the first part are included the following several improvements:—

The first relates to the treatment of anthracite coal.

The second to the treatment of bituminous coal.

The third to the treatment to be applied to coal by cleansing the same.

The fourth to the treatment of Bovey coal, Kimmeridge coal, and Brora coal.

The fifth to that portion of the coal which becomes ammonia.

The sixth to the treatment of that portion of the coal which results in liquid hydro-carburets.

These six processes are so many links in this system of treating coal and every one of them holds its appointed place in that system to render it complete as a whole.

The first of these, that relating to the treatment of anthracite coal, is as follows:—The coal to be operated upon is broken into small pieces, and reduced to a state of coarse powder, by any ordinary and convenient means known and employed for crushing materials. To the coal in this state is added 15 per cent. of bituminous coal, which has also been previously crushed, and reduced to a similar state of coarse powder. These are to be well mixed and incorporated together; a small quantity of water is introduced, for the purpose of moistening the mass. The specification describes, and the drawings accompanying it shows, an apparatus which the patentee employs for mixing the two descriptions of coal together. It consists of two hoppers placed close together, into one of which the powdered anthracite coal is placed, the powdered bituminous coal being placed in the other. In the lower part of each hopper is mounted a grooved or recessed roller, to which a revolving motion is given,—the powdered coal, by entering into the grooves or recesses in the rollers, being carried down, and allowed to fall in a box beneath common to both hoppers. The velocity with which the grooved rollers rotate determines the quantity of coal passed from the hopper to the box, which, being adjustable at pleasure, determines the proportion in which the two descriptions of coal are mixed. At one end of the box, in a direct line with the two falling streams of coal dust, an artificial current or draught of atmospheric air is caused to enter; this blows the coal dust falling from the first hopper amongst the coal dust falling from the second hopper, thereby mixing them intimately together. Before the mixed coal dust arrives at the bottom of the box, a small shower of water from a rose-end of a pipe is directed amongst it, by which it becomes moistened. The mixed coal is now submitted to the apparatus for effecting the destructive distillation, for the production of liquid hydro-carburets and coke. The construction of this apparatus is as follows:—The retort for receiving the mixed coal is constructed of brick, in the same manner as those manufactured by Mr. Spinney, of the Cheltenham Gas Works. The retort is of sufficient capacity to contain six tons of the mixed coal at each charge. It is placed horizontally in the furnace, and is provided with a door at each end, for convenience of charging the coal, and withdrawing the coke. There is an opening in the upper part of the retort, by which a communication is effected between the interior of the retort and the furnaces and flues surrounding it. This aperture, however, can be effectively closed in an airtight manner, by means of a sliding valve. In each of the doors of the furnace openings are provided, but they can be closed at pleasure by means of slides attached to them. The retort is likewise connected by suitable pipes with the ordinary condensing apparatus, employed in the manufacture of gas, but a means is provided of shutting off that communication, when desired, at a certain part of the process, which is as follows:—The charge of mixed coal, prepared as before stated, is charged into the retort, the aperture in the top of the retort communicating with the flues and furnace is closed by the valve, the doors of the retort closed and luted, and the communication with the condensing apparatus opened in the same manner as when manufacturing gas by the usual process; bituminous vapour is evolved and flows over to the condensing apparatus, but the temperature is not to be raised above nascent red heat, or about 964 deg. Fahrenheit; this state continues for about fifty hours, when the temperature is to be increased to a bright red heat, at which it is allowed to remain until the sixtieth hour of the process, when the communication with the condensing apparatus is shut off, and the valve withdrawn from the aperture in the top of the retort, by which the communication will be opened between the retort and the furnace flues, and, at the same time, the three openings in each door of the retort are opened successively at short intervals so as to allow the atmospheric air to enter, which burns the bituminous vapours and gases now produced, and the caloric of that combustion heats the retort, also the bulk of masonry in passing through the flues, which surround the retort, in order to store heat for the following charge of coal. About the eighty-fifth hour, the small openings in the doors are closed, and about the ninety-sixth hour, the process will be complete, and the coke being allowed to cool may be withdrawn, the retorts are then ready to receive a fresh charge. The products obtained from this process are the coke, ammoniacal liquor, and the hydrocarburets.

The second improvement, relating to the treatment of bituminous coal, is conducted in the same manner as the foregoing, with the same apparatus, and with the same results.

The third improvement relates to cleaning coal and separating from it pyrites and other impurities with which it is contaminated, and which, when allowed to remain mixed with the coal, and submitted to the distillatory process, considerably impair the quality of the ammoniacal liquor and the coke produced. The means by which this is effected is as follows:—The coal to be operated upon is to be reduced to a coarse powder, as before described, by any convenient means; the powdered coal is then placed upon the inclined bottom of a

trough, not over the whole of the bottom, but only upon one end; it is here kept in motion, or stirred, and submitted to the action of a current or draught of atmospheric air, blown by any ordinary apparatus. The current of air carries off with it the particles of coal being of less specific gravity than the pyrites and other impurities, which are left behind upon the inclined bottom. The coal carried off by the current of air, will fall upon the other part of the bottom of the box, and may be removed at pleasure, freed from the pyrites and other impurities. The specification describes another mode of effecting the same object, by the employment of a stream or current of water, instead of that of atmospheric air, for carrying off the particles of coal, the apparatus employed being of the same construction. In this mode of operating, the water carries off the lighter particles of coal, leaving the heavier ones of the pyrites and other impurities behind.

The fourth improvement relates to a peculiar mode of treating those descriptions of coal known as Bovey, Kimmeridge, and Brora coal, for the purpose of rendering them fit to be used for ordinary purposes. These descriptions of coal contain mixed with them other matters, prejudicial to their use, as a large quantity of water, amounting sometimes to 25 per cent., and a large quantity of hydrocarburets, which are extremely volatile, and consequently volatilize rapidly, and become dissipated and lost. The object of the present improvement is to evaporate the water, and collect the hydrocarburets for useful purposes. The operation consists in submitting the coal to heat, and the action of heated steam. The apparatus employed by the patentee is as follows:—Over a suitably-arranged furnace or fireplace is placed a large square vessel or box, the entrance or door of which is at one end, outside the furnace; the flues from the fireplace pass along the bottom and up the sides of this vessel, which, therefore, become highly heated. The vessel is large enough to contain within it a large carriage, provided with several shelves; the wheels of the carriage move upon rails, laid down both inside and outside of the vessel or oven, so that the carriage can be passed into, and withdrawn from the oven, as desired,—the door of the oven closing in an air-tight manner, confining the carriage, and what may be upon it, within the oven. The process of operation is thus:—The carriage being outside the oven, the coal to be operated upon is spread in a thin layer upon the shelves of the carriage, of which there may be four or five; the carriage is then passed into the heating vessel or oven when at its proper heat,—being that at which steam of 700 deg. Fahr. may be admitted without condensation taking place. As soon as the carriage is passed into the vessel, the door is tightly closed, and streams of heated steam, of the temperature stated, namely 700 deg., is allowed to play upon the coal on the several shelves. The steam is conveyed from a steam boiler through an apparatus of coiled pipes placed in a furnace and highly heated, by which the required temperature is obtained, it passes thence into the heating vessel or oven, where it plays, by numerous jets through apertures in the pipes, upon the coal, and as a consequence, the water contained in the coal, now in a state of vapour, and the hydrocarburets, are conveyed away, and are passed into a condensing apparatus, where they are condensed, and the coals become highly dried and heated.—so much so, that upon being exposed to the open atmosphere, they would instantly take fire. This operation continues about two hours, when the injection of the steam is stopped, and the carriage and its contents withdrawn from the oven, and immediately passed into another chamber, which is closed up to exclude atmospheric air. The coal is here allowed to cool, and when sufficiently so can be withdrawn, and is now in a fit state for use, being a superior dry coal, of an entirely different character from what it was before the operation, and fit for household purposes.

The fifth improvement relates to the mode of treating and operating upon the ammoniacal products obtained from coal by distillation, for the purpose of obtaining from them sulphate of ammonia. The process is as follows:—The ammoniacal products are combined with oxide and sulphate of lead, which the patentee obtains and prepares as follows:—Sulphuret of lead in its natural state is taken, and reduced to small fragments by any convenient crushing apparatus. It is then submitted to a roasting process in a suitable arranged reverberatory furnace of the following construction:—The furnace is formed with two shelves, or rather the bottom of the furnace and one shelf, and there is a communication from the lower to the upper. The galena or sulphuret of lead, previously reduced, is then spread over the surface of the upper shelf to a thickness of about 2 or 2½ inches, and there it is submitted to the heat of the furnace. It remains thus for the space of about two hours, at which time it is drawn off the upper shelf and spread over the lower shelf or bottom of the furnace, where it is exposed to the more intense heat of the furnace for another space of time; but during the time it remains upon the lower part of the furnace it must be kept well stirred and moved about, for the purpose of exposing all the parts equally to the action of the air and to prevent any fusion of it taking place. By this process the sulphuret of lead becomes converted, part into sulphate and part into oxide of lead; the oxide is composed part of minium and part of oxide *puce*. This product of sulphate and oxide of lead is to be crushed by any ordinary means, and reduced to about the same degree of fineness as coarse sand. It is then to be combined with the ammoniacal liquors previously obtained from the distillation of coal, when sulphate of ammonia and sulphuret and carbonate of lead will be produced. The liquid product is then to be evaported to dryness, for the purpose of obtaining the sulphate of ammonia in a dry state. The mixture of lead being revivified by calcination may be employed again and again.

The sixth improvement relates to a mode of treating and preparing hydrocarburets, so as to render them more useful to be employed for the manufacture of gas, and also for other purposes to which they may be applicable. It is a peculiar property of the hydrocarburets that, when subjected to repeated distillations, their specific gravities become altered and the points of volatilization reduced. The patentee takes advantage of this property and operates upon the hydrocarburets by repeated distillation, at high temperatures, until the desired degree of purification is obtained. At the commencement of the process, when the hydrocarburets are in the state in which they are produced, the volatilization takes place at a temperature of 250 deg. Fahrenheit, and after the process that point is 140 deg.; the purification proceeds gradually; the specific gravity and the volatilizing vary as the number of distillatory processes.

The second specification describes improvements in the manufacture of gas for the purposes of illumination; and relate, first, to a mode of manufacturing gas upon a large scale, and to the manufacture upon a smaller scale.

The first of these improvements consists in making use of the tar produced in the ordinary manufacture of gas from bituminous coal, for the purpose of improving the quality of poor gas and increasing its illuminating power. The apparatus described by the patentee, to be employed for this purpose, consists of a set of three ordinary iron retorts set in a furnace, and intended to receive the coal to be operated upon. Within the furnace are also several cast-iron pipes, placed in such a position as to be acted upon by the heat, and become red hot. These pipes contain coke; they have a communication with the retorts and also with the condensing and purifying apparatus attached. Above the furnace is placed a tar reservoir, which communicates with a regulating and measuring apparatus attached to each retort, by which the required quantity of tar is passed into the retort at the proper time, valves shutting off the communication between the tar measures and the retorts. The mode of operation is as follows:—The coal being charged into the retorts and the doors securely closed and luted in the ordinary manner, the decomposition and distillation commences. The bituminous vapours, the first products, are allowed to pass through the pipes in the furnace, where they are decomposed by the red-hot surfaces in their passage through them. This continues for about one hour and a half, when carburetted hydrogen is evolved; this gas is not allowed to pass through the red-hot pipes, but is conveyed away direct to the hydraulic main of the condensing apparatus. The gas passing over is of a rich quality, and continues to be evolved for about one hour, when it becomes poorer and of inferior illuminating power. For the purpose of increasing this and rendering it equal in richness to that previously passed over, the valves communicating between the tar measures and the retorts are opened, and tar passes into the retorts, which, being vaporised, and the vapours evolved from it combining with the poor gas evolved from the coal, passes off through the hydraulic main to the condensing and purifying apparatus. But instead of passing off direct to that apparatus, as was the case with the richer carburetted hydrogen gas, it is diverted and caused to pass through the red-hot pipes in the furnace, and hence to the hydraulic main, thus producing a rich gas. This part of the process continues for about one hour and a quarter, when the valve is closed and the coke withdrawn, the operation being completed in about four hours.

The second improvement relates to the purification of gas, and consists in the employment for that purpose of oxide of lead and sulphate of lead. These substances are mixed intimately together and placed in the ordinary lime purifiers in a moist or wet state, the use of lime at the same time in the purifiers being omitted. The gas to be purified is submitted to the action of these substances in the same manner as when lime is employed. When the mixture becomes non-effective in the purifiers it is to be removed, submitted to a washing process with ammoniacal liquors, and then again employed after being revivified by the process above explained.

The third improvement relates to the manufacture of gas in small quantities, by means of a small apparatus. The patentee does not propose to employ raw coal for the purpose, as is usually adopted, but to employ that portion of it containing the hydrocarburets only; by this means an apparatus of far less magnitude is required than when raw coal is employed, no purifying apparatus being necessary; and the condensed results may be again repeated to the retort or apparatus to be again operated upon. The patentee states that the apparatus usually employed for the manufacture of gas from camphine and resin may be employed, but he prefers the employment of a somewhat modified apparatus suitable to the material employed.

The third part of the specification relates to the burning or employment of gas, and the improvements consist—

First—Of an improved construction of gas burner.

Secondly—An improved gas-stove or calorifier.

Thirdly—A gas regulator or economizer.

The gas burner, which forms the first of these improvements, is constructed in such manner that the quantity of gas issuing from the burner may be increased or diminished at pleasure, the gas issuing in the form of a circular sheet or ring, and not a series of apertures, as usual; also a means of regulating the quantity of atmospheric air admitted to the interior of the flame. The exterior of the burner, at its lowest part is cylindrical, and that at the upper part conical; this outer part is soldered to a ring, and the inner portion of the burner, which is cylindrical, is likewise attached to the ring by means of a fine threaded screw, so that it can be raised or depressed, and thereby cause the upper edge of the inner cylindrical part, to approach to or recede from the upper edge of the outer part. The inner part can be raised or lowered by means of a key or instrument. A cone can be raised or lowered by means of a screw to which it is attached, passing through a bridge fixed to the stem of the burner, so as to regulate and adjust the quantity of atmospheric air admitted to the interior of the burner.

The second improvement—the gas stove or calorifier, consists of a stove of firebricks, enclosing a system of vertical tubes, connecting together an upper and lower chamber, with one large central pipe or chimney communicating with the upper chamber only; at the bottom of this chimney is placed a large gas burner of the construction above described; the products of combustion pass through the chimney into the upper chamber, then down the vertical pipes into the lower chamber, and from thence to the exit chimney. The

chambers and pipes are placed in the hollow body of the stove, and the air surrounding it is thereby heated.

The regulator or economizer described as the third improvement, is constructed as follows:—An inverted vessel is placed within a large closed vessel containing water; this is balanced by a balance-weight from a lever, and carries a valve placed upon the end of the gas discharge pipe, so that upon any variation in the pressure of the gas upon the floating vessel, it will rise or sink in the water accordingly, and consequently open or close the valve of the exit gas pipe to a greater or less extent, according to the pressure. The regulator is to be placed in the pipe of communication between the gas meter and the gas burner.

The patentee claims under the first part of the specification—

The improvements in treating anthracite coal and also bituminous coal in the manner before described in chapters 1 and 2, and also in treating certain of the products from the same, as described in chapters 5 and 6, as combined with the processes described in chapters 1 and 2.

He also claims as new the improvements in treating Bovey coal, Kimmeridge coal, and Brora coal, in the manner described in chapter 4, and as combined with the mode of treating certain products therefrom, as described in chapters 5 and 6.

He claims as new the application of air to the separation of coal-dust or powder, from the dust or powder mixed therewith arising from impure materials, as described in chapter 3, and he also claims as new the washing or treating with water in an apparatus such as is described in chapter 3, of coal-dust or powder, so as to separate the same from the dust or powder of impure materials mixed therewith.

Under the second part—

The process or method hereinbefore described in chapter 1 of the second part of this specification, and the accompanying drawings resulting in an increased production of rich gas, and also of such parts of the apparatus described in that chapter, and the accompanying drawings, as are stated to be new. He claims also as new the purification of gas in such manner as is described in chapter 2 of the second part of this specification, to the extent that the same is effected by a repeated application of the same purifying materials as therein set forth, combined with the result of obtaining the sulphate of ammonia of commerce.

He claims as new the manufacture of coal-gas from the liquid hydrocarburet before described in an apparatus not requiring a heat exceeding 900 deg. to gasify such liquid, and at the same time dispensing in such manufacture with a purifier.

Under the third part—

He claims as new such parts of the burner described in chapter 1 of the third part of this specification, and the accompanying drawings, and the mode of fixing and moving portions of such parts as enable rich and poor gas to be burned to the best advantage, as therein described, and the air regulated to feed the flame with the minimum of air required, the whole being and working in connection with the gas-economiser lastly described.

He claims also as new the gas-stove or calorifier as described in chapter 2 of the third part of this specification, and the accompanying drawings, fitted with a burner and air-regulator worked as therein described, the whole being and working in connection with the gas-economiser lastly described.

He also claims as new, as a separate improvement in the apparatus for burning gas, such parts of the instrument or gas-economiser described in chapter 3 of the third part of this specification, and accompanying drawings, as consist in the mode of suspending the cap on the knife-edged centres, and in the machinery which makes the piston-rod and valve, as before described, follow the inverse movements of those of the cap, and thence to keep up an unvarying and equal supply of gas to the burners, whatever may be the pressure on the main.

Miscellaneous News.

ROYAL SCOTTISH SOCIETY OF ARTS.

This Society commenced its annual sittings on the 11th ult., in its new and commodious hall, George-street, when Thomas Grainger, Esq., C.E., the President, opened the session by an eloquent address.

The following paper was read:—"An Account of the Chimney of the Edinburgh Gas Works, with Observations on the Principles of its Strength and Stability." By GEORGE BUCHANAN, Esq., F.R.S.E., C.E.

In Part I. of this paper Mr. Buchanan gave a very interesting account of this remarkable structure, and the principles of its strength and stability. It was one of the works particularly alluded to by the President in his interesting introductory address last year, and of which he thought it important that the Society should have some account; and Mr. Buchanan having been professionally connected with the work, had much pleasure, at the President's request, in now stating what he knew of it. Having communicated also on the subject with the Gas Company, Mr. Watson, the manager, was most anxious to give information and every facility in his power to forward the great objects of the society; and Mr. Taylor, the engineer of the works, and by whom the chimney itself was designed, has made out a detailed description and drawing, showing minutely the dimensions and structure of every part of the work, and which he now requests Mr. Buchanan, along with his paper, to present to the society.

It was about the year 1848, owing to the extension of the works, that it became necessary to obtain increased chimney accommodation, both for increasing the draught of the furnaces and for carrying off the smoke and vapours from the works, and clear away from the neighbourhood by raising the chimney to a greater height. Three chimneys were then on the works, the highest of them rising 148 feet, and not exceeding 2¼ feet square internally at the top. These gave vent to the smoke and vapours of 68 furnaces, heating 178 retorts, but were inadequate to work these effectually, and to give proper ventilation for cooling and purifying the retort houses for the comfort of the workmen, still less to meet the extensions of the works then contemplated and since executed. Instead of continuing, however, the system of small and low chimneys, and adding to their number, the plan came to be considered of raising one single chimney, sufficiently large and lofty to receive the flues from all the furnaces, and by one powerful column of heated air to work these, and any contemplated extensions, in a more effectual manner than hitherto, and so as to supersede the others and render any addition unnecessary for a long period. The idea had been acted on in some works already, and the magnificent chimney of St. Rollox chemical works furnished a favourable example. No way deterred, therefore, by the anticipated difficulties, or the great cost of the undertaking,* seeing especially that it promised beneficial results to the public, the directors determined to proceed with the plans made out at their request by Mr. Taylor. Having previously, however, requested Mr. Buchanan's opinion and advice thereon, he then carefully considered the whole subject, approved of the general design, and suggested only slight modifications in the form of the column and other points; but to Mr. Taylor still belonged the merit of the design, which he thought was great, as well as his talents and skill in superintending the work.

Mr. Buchanan then proceeded to state from his reports some of the facts and principles regarding the work, which apply generally to all similar undertakings. And, first, in regard to the form of the structure, whether round or square; the square had been usually adopted in the works, but in the case of an altitude from 300 to 400 feet the round form was decidedly to be preferred, as presenting a less effective surface to the wind, whose violent action in this quarter it was important to diminish by every means. The effect of the wind on a cylindrical surface as compared with a square had been calculated by theory in the ratio of two to three. This is the Law of Resistance so beautifully demonstrated by the commentators on "Newton's Principia." Subsequent experiments had proved the effect on the globe and cylinder to be, if anything, rather less than theory, so that we are quite safe in taking it at ⅔rds; the result is, that with 300 tons, for example, acting on a square tower, we have only 200 on the cylinder of the same diameter, which is most material. The bricks also, by being moulded to the circle, can be built and bound together with all the strength of the arch. On the lower part of the building, again, which is less exposed, and to be built of stone, the square and pedestal form are preferable.

Secondly. The building being intended to be 300 feet and upwards in height, the question arose how far the ordinary brick could withstand the pressure arising from so lofty a column. This difficulty was provided for by the increasing thickness of the walls of the chimney from the top towards the bottom, whereby the incumbent pressure being distributed over a larger and larger surface in descending, was diminished in proportion. The whole height from the foundation to to the top is 341½ feet; of this 77½ feet are occupied by the foundation and square pedestal of stone, and 264 feet by the brick-work, the thickness of which was diminished towards the top by five successive steps. The upper division extended 83 feet down, and was 15 inches thick, and the internal diameter 11 ft. 4 in. at top; the 2nd division 58 feet and 20 inches thick; the 3rd, 48 feet and 25 inches; the 4th, 40 feet and 30 inches; and the 5th, 35 feet and 35 inches thick, and internal diameter 20 feet. On calculating the weight and pressure on each of those divisions, on the first it was found not to exceed 4½ tons on each square foot; in the middle it increased to 7 tons, and at the base it increased to 8 tons on each square foot. The strength of ordinary brick being estimated at from 20 to 30 tons, the work seemed within the limits of safety; but on finding that a composition brick could be obtained in the neighbourhood, from the brick works of Mr. Livingston, of Joppa, of much superior strength, Mr. Buchanan strongly recommended these, and also suggested experiments on their strength, of which he would give farther details on another evening, but found the first specimen tried bore at the rate of 440 tons to the square foot, a degree of strength almost incredible in such material. The results of the other experiments were somewhat similar, and all such as to set at rest any fears of the result. In regard to the sufficiency of the foundation itself, although this sustained the whole mass of the building, amounting to 4000 tons, yet the weight being spread over the entire area of the solid base, 40 feet square, it did not exceed 2½ tons to the square foot. And the material consisting of very hard till or blaes, of pretty equal solidity throughout, this appeared to form a good and sufficient foundation; and in order to be perfectly secure, the building at one of the angles was carried deeper than the rest, to obtain the same hard and solid bearing throughout. The result of these precautions, it is now very satisfactory to observe the structure standing perfectly upright and entire, without a crack or flaw of any description to be found in it.

The next object of importance that came to be considered was the effect of high winds on the building. From experiments it was calculated that the force of a storm or tempest is equal to 12 lb. on the square foot of surface directly exposed; a great storm, 18 lb.; a hurricane, 30 lb.; and one capable of tearing up trees and oversetting buildings, 50 lb. There is no instance, however, of such a hurricane occurring in this country, and we are quite safe in assuming 40 lb. per foot, or 90 miles an hour, as the utmost power of the wind in this country. The French engineer, Fresnel, in an interesting memoir on the stability of the lighthouse of Belleisle and various other lighthouse structures compared with it, has assumed the force of the wind at 55 lb., agreeing with the estimate of another engineer, Navier; but this is evidently much beyond the truth, and the effect was to bring the gas chimney in Paris below the zero of stability, although it stands as yet quite secure. Consider only the human body, which presents a surface from four to six feet square. Such a force of wind would be equal to a pressure of from 200 to 300 lb., and the power to overset at least equal to 500 lb., which no one could sustain for a moment, and

* The whole cost of the work has been little short of £5000. One of much less magnitude would have been sufficient for immediate wants—but after due consideration they thought it best to do the plan effectually at once.

even the ordinary inclosure walls or chimneys would be immediately prostrated by it. Besides, it appears from observations of wind gauges, and particularly of one by Mr. Adie, of this city, that the greatest force indicated on it for several years was only 14½ lb.; and another gauge, kept for several years at Granton Pier, and now at the Observatory, never indicated more than 18½ lb., and this was at Granton on the 9th and 27th of April, 1847. If we allow 40 lb., therefore, we are quite safe, this being nearly double what ever occurs.

Another point must be kept in view, that the tendency to overset the structure is greatly increased by the altitude, and this, in fact, exactly in proportion as the height exceeds the breadth of the base. It might happen also, if the strength of the different portions of the column were not duly proportioned, that it might be overset, not at the base, but at some intermediate point between it and the top. Applying these views it was found that, in the upper division, 83 feet down from the top, the force of the wind was 14½ tons, and this increased by the height and narrow base to 70 tons, while the actual weight was 270, giving a preponderance of stability of 3¾ to 1.

Taking the middle division 189 feet from the top, the force of the wind was 37 tons, and this increased by altitude to 318 tons; but the weight of the structure being 880, there still remains a preponderance of stability of 2¾ to 1.

At the base of the column the force was 63 tons, increased by height to no less than 630, while the weight was 1670 tons, giving a preponderance of 2¾ to 1, or rather less than the other points, and showing that the column could not overset but at the base.

At the base of the pedestal, again, the stability was fully greater, being 3½ to 1.

These results appeared very satisfactory, and the execution of the work has strikingly confirmed them. The stability and steadiness of the chimney, even in high winds, is remarkable; and while the old chimney, which is not half the altitude, is seen oscillating most sensibly by the naked eye, it is difficult to detect the smallest movement in the other by accurate telescopic observations with the theodolite. It is only in a violent gale, such as occurred on November 7, that even a slight degree of oscillation could be distinctly observed. And when we consider how very usual it is for structures of this kind to oscillate in high winds (and even some of the lighthouses, which are of a more solid character, are not exempt from it), is a strong proof of the strength of the work.

Drawings were then exhibited, and the comparative stability calculated of the small gas chimney, and of several other chimneys here and in France, all which were considered below the present, and the French one pronounced by Fresnel as showing great hardihood; also the relative proportions and heights of some lighthouses; and, lastly, a comparison was made, and drawings exhibited and described, of the great chimney of St. Rollox, 455 feet in height, and consisting externally of a single cone tapering from the base to the summit, but not quite regularly, 41 feet in diameter at the base and 13 at the top. The walls are in five divisions, increasing in thickness from top to bottom.

Another source of danger to be guarded against in these chimneys is the intense heat which often arises from the furnaces, and the powerful draught of the chimney. As a protection, an interior tube or chimney is generally built of brick standing clear of the outer chimney, and on which the effects of intense heat may be expended before it reaches the main exterior chimney. This is very effectual, but still the heat is great in issuing from the inner chimney, which should not be carried too high. In the present case the inner chimney, 13 feet diameter, and lined with fire-brick, rises only 70 feet, and the walls of the chimney being then 35 inches thick, present great resistance; but, as an additional precaution, he recommended near this part hoops of iron, which have been carried at intervals of 35 feet all the way up within, and enclosed by the brickwork, so that they are not visible.

The only point remaining to be considered, and to which Mr. Buchanan's attention was particularly called, was the expediency of protecting the building by a lightning conductor. He had formerly, when the old chimney was erected, been consulted as to this, and considered it unnecessary, the height being moderate, and doubts being then entertained of the efficacy or expediency of such instruments. Much, however, has since been added to our knowledge and experience on this subject, and on the beneficial operation of conductors; so that he had no hesitation, the altitude also being so much greater, in recommending it. But having requested to be favoured with the views of a friend and high authority, Professor Faraday, he gave an extract from his letter as follows:—"The conductor should be of half-inch copper rod, and should rise above the top of the chimney by a quantity equal to the width of the chimney at the top. The lengths of rod should be well joined metallically to each other, and this is perhaps best done by screwing the ends into a copper socket. The connection at the bottom should be good; if there are any pump-pipes at hand going into a well they would be useful in that respect. As respects electrical conduction, no advantage is gained by expanding the rod horizontally into a strap or tube; surface does nothing, the solid section is the essential element.* There is no occasion of insulation (of the conductor) for this reason: A flash of lightning has an intensity that enables it to break through many hundred yards (perhaps miles) of air, and, therefore, an insulation of 6 inches or 1 foot in length could have no power in preventing its leap to the brickwork, supposing that the conductor were not able to carry it away. Again, 6 inches or 1 foot is so little that it is equivalent almost to nothing. A very feeble electricity could break through that barrier, and a flash that could not break through five or ten feet would do no harm to the chimney.

"A very great point is to have no insulated masses of metal. If, therefore, hoops are put round the chimney, each should be connected metallically with the conductor, otherwise a flash might strike a hoop at a corner on the opposite side to the conductor, and then on the other side on passing to the conductor, from the nearest part of the hoop there might be an explosion, and the chimney injured there or even broken through. Again, no rods or ties of metal should be wrought into the chimney parallel to its length, and, therefore, to the conductor, and then to be left unconnected with it."

In answer to some further inquiry, Professor Faraday again writes:—

"The rod may be close along the brick or stone, it makes no difference. There will be no need of rod on each side of the building, but let the cast-iron hoop and the others you speak of be connected with the rod, and it will be in those places at least as if there were rods on every side of the chimney.

"A three-fourth rod is no doubt better than a half-inch; and, except for expense, I like it better. But a half-inch has never yet failed. A rod at Coutt's brewery has been put up 1½ inch diameter; but they did not mind expense. The Nelson Column in London has a half-inch rod; three-fourths is better.

"I do not know of any case of harm from hoop-iron inclosed in the building, but if not in connection with the conductor I should not like it; even then it might cause harm if the lightning took the end furthest from the conductor."

The rod was constructed nearly according to these directions, of ⅝-inch copper, and the effect of it was very remarkably exemplified during the progress of the work. It was carried up regularly along with the building, and during the storms, or very electric state of the atmosphere, the electric fluid was distinctly perceived running down the rod, by a loud singing noise given out by it, arising from a tremor or vibration into which it was thrown by a little play in the studs or eyes through which it passed in the building, and during these times the workmen were by no means fond of approaching too near it, but no harm ever occurred to any one from it.

The work of the chimney was commenced by laying the foundation on the 3rd of June, 1845, and during the course of that season the mason-work of the pedestal was completed, and the work allowed to stand till the spring. The brickwork of the shaft was commenced on the 2nd of May, 1846, and proceeded rapidly during the summer. The bricks and all the materials were taken up in the inside by means of a steam-engine working at the bottom, and winding a rope over a barrel, and this passing over a pulley on the top of the building, the materials were raised with the greatest facility; and it was curious to observe from different parts of the tower the work gradually rising, and the workmen steadily going on, at the great elevation to which they at last attained. A model was shown of a very simple apparatus, by which the stage for the materials and timbers was raised by successive lifts, as the building rose in height.

The contractors for the mason-work of the stone pedestal were Messrs. Gowan, and for the brick-work of the stalk, Messrs. Bow, of Glasgow, to whom much credit is due for the superior style in which they have finished their work; and it may also be mentioned that no accident or casualty of any serious nature occurred during the execution of this great work.

Several operations still remained to be made on Part II. as to the draught of the chimney, but were deferred to another day, to give time for the distribution of the prizes for last session.

Thanks voted to Mr. Buchanan.

* The very reverse of what was formerly held by high authorities.

GREAT CENTRAL GAS CONSUMERS' COMPANY.

An extraordinary general meeting of the shareholders in this company was held at the London Tavern on the 27th ult., "to consider the propriety of prosecuting a bill in Parliament for regulating the company already incorporated under the act 7 and 8 Vict., c. 110." The meeting was very numerously attended. Mr. Thomas Dakin presided.

The CHAIRMAN said the directors considered the subject to be brought before the shareholders most important, and, therefore, they wished to receive their advice. At the outset of the movement for cheap gas the directors pledged themselves to the commissioners of sewers to apply for an act to perpetuate to the public all the advantages which, from the first, they had contemplated. It would be remembered that on two occasions they had been before Parliament. On the second of those occasions a committee of the House of Commons—as intelligent as could be chosen, the chairman of which was one of the ablest members of the house—after a lengthened and most patient investigation of the estimates and all the circumstances, unanimously passed the bill. This application was, of necessity, attended with very considerable expense, but the directors considered, and he believed the shareholders would consider those expenses by no means thrown away. The company had been before one of the most competent and impartial tribunals that could be found for the investigation of their claims, which tribunal had pronounced a clear verdict in their favour. But for that verdict their position would not have been so proud as it was; and on this account he held that the expenditure which had been incurred was by no means thrown away. They were now a company completely established; their works had been, and would be, within the estimate; their mains and pipes were laid down. More than 3000 consumers were now actually burning the company's gas, and double that number were about to be connected with them. In this respect, therefore, they were in a proud position. But it was for the consideration of the shareholders whether, having attained this position at considerable expense, the directors should be invested with a qualified authority to prosecute further proceedings in Parliament. If they could see their way to obtain the measure without incurring any very large expenditure, would the shareholders give them that power?

Mr. HARDWICK then read the following report from the directors:—

"TO THE SHAREHOLDERS OF THE GREAT CENTRAL GAS CONSUMERS' COMPANY.

"Gentlemen,—The period has arrived for the consideration of the expediency of applying for an act of Parliament to confer increased power on our company. The subject has received the attention of your board, and

mindful of the pledge given to the commissioners of sewers to take measures for obtaining an act for the purpose of insuring in perpetuity the advantages proposed to the public, they deem it desirable to have the power to take the necessary steps for that purpose, if it should hereafter appear to them that this can be effected without the large expenditure which has attended the previous applications.

"For the purpose of assisting the directors to judge of this, they have deemed it desirable to address a communication to each of the City gas companies, inquiring if they contemplated opposition. These letters, with their answers, are appended thereto.

"Your directors feel that the different circumstances under which they would now apply to Parliament, in the event of an opposition being carried out, would very much narrow the ground of contention. Our pipes are now laid. Our works will in a very few days be completed, and, as your directors have every reason to believe, within the estimates given. Our services, to the number of nearly 5370, are laid; meters, actually connected up to Saturday last, 3213; and 22,017 lights now burning; therefore we do not see on what ground the structure of opposition can be raised.

"Added to this your directors think it not improbable that on proper application to the Corporation of London, that body, with whom, upon the petition of the citizens, the measure in favour of the reduction of the price of gas originated, may be induced to give their powerful aid in the accomplishment of a measure so obviously for the advantage of the citizens of London."

The correspondence with the Chartered Gas Company and with the City of London Gaslight and Coke Company was then read. The replies of both companies appeared to afford no expectation of the question being decided without a contest. The following is a copy of the correspondence with the City of London Gas Company:—

"Great Central Gas Consumers' Company,
28, Coleman-street,
22nd November, 1850.

"Gentlemen,—We have given notice of our intention to apply to Parliament, in the ensuing session, for an act to secure in perpetuity to the gas consumers within the City all the benefits this company was formed to confer upon them, and likewise to place the company and the public in respect of their mutual rights, duties, and interests, in the same position as your own, and all the gas companies of the metropolis now occupy.

"We have convened a meeting of our shareholders for the 27th instant, to consider the expediency of our now proceeding with the bill.

"Under ordinary circumstances the shareholders would have a right to expect from the directors of this company some explanation of the uses of the bill, and the probability and expenses of obtaining it; a full explanation upon all these topics has been rendered doubly necessary by a published letter from Mr. Timothy Tyrrell (acting avowedly on the title-page as solicitor of your company), in which, after comparing the founders of this company with highway robbers, and branding its shareholders as insolvents—incapable of paying even their taxes—he charges the directors with having already 'wasted £17,000 in law, or in litigations, and in reckless competition with rival gas companies, before a pipe was charged with gas.'

"Although Mr. Tyrrell's statement is somewhat exaggerated, it is, as regards the cost, to a great extent true, very large sums have been wasted in law and litigation in the two last sessions, but upon Mr. Tyrrell and his clients rests the heavy responsibility of causing the waste of property he now affects to condemn. Had he not, by his celebrated circular, founded a confederacy of gas companies throughout the empire to influence members of Parliament to throw out this company's bill, and thus, as they thought, to uphold monopoly, and compel the citizens to continue to pay 6s. per thousand for their gas, this company's act would have been obtained in the first session at an expense of £700 or £800, whereas they were compelled to expend many thousands, and Mr. Tyrrell is said to have received from the City companies, or from the confederated companies, a much larger sum.

"When it is recollected that the money thus wasted in the two sessions amounts to above 1s. a thousand cubic feet upon the entire gas consumption of the City, the consumers will be able to estimate at its proper value the amount of obligation they owe to Mr. Tyrrell and his confederated companies for devising this mode of postponing the reduction of price of gas in the City.

"Having been given to understand the gas confederacy is now at an end, we have thought it right to inquire of the directors of the Chartered Gas Company, whether it is their intention to involve themselves and our company in further expense by again opposing our bill.

"In an affidavit sworn by their secretary it is expressly stated that it is necessary for the public safety, and for the benefit of other gas companies, that this company should be bound by act of Parliament in the same manner as they are bound; in our letter we have offered, if they will undertake not to oppose our bill, that we will give an undertaking to introduce a clause interdicting us from laying pipes in the district supplied by them beyond the limits of the City.

"We now make the same offer, and we request the favour of a reply, that we may lay it before our shareholders on the 27th.

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"I have the honour to be, gentlemen, your obedient servant,
"R. M. Massey, Sec.

"D. Benham, Esq., City Gas Company, Dorset-street."

"Guildhall Yard, 26th November, 1850.

"Gentlemen,—Your letter of the 22nd of November, 1850, under the signature of your secretary, R. M. Massey, addressed to the City of London Gas Light and Coke Company, has been referred to me.

"Upon perusal of the letter my first impression is that it is not issued with your individual sanction. I therefore suggest your personal perusal of it.

"The letter is evidently written for publication, and must be so considered.

"Amidst the tirade of humbug to catch the unthinking, the garbled statement and the falsehood, there appears a sentence which may, perhaps, mean that my clients are expected to answer the letter. "Now we make the same offer, and we request the favour of your reply, that we may lay it before our shareholders on the 27th." I presume the offer is to be answered, but that must be a matter of inference, which seems to have for its object to enquire if the City of London Gas Light and Coke Company intend to oppose your proposed bill in Parliament. The best answer I can give is that I (following instructions) have already retained Mr. Talbot, Mr. Hope, and Mr. Burke, for my clients have, throughout this contest, acted on the defensive only, and I hope to have evidence before the committee of the House on the following points for the benefit of the shareholders of your company who have entrusted their property to your protection for a dividend of ten per cent., and a bonus, and a reduction in the price. (I mean the 6000 gas consumers who did or did not subscribe as shareholders.)

"1. The amount of gas registered *to* you, and for which you are to pay, and the amount supplied *by* you to your customers. In other words, what is the leakage? Mr. Croll stated in evidence that he allowed one-sixth for leakage, and considered it large for the City.

"You have the means of ascertaining the fact of leakage. If you do not individually do it for yourselves, are you not continuing a deceit, even though you may escape from the charge of originating it?

"2. What do you pay for your coals?

"3. What do you get for your coke?

"4. Have you 6000 consumers?

"5. Have Messrs. Rigby performed their contract?

"6. Does the patented process of Mr. Croll as to the retort answer, or is it not a complete failure—a humbug?

"7. Ditto, as to purifying?

"8. Is the gas more pure, or does it afford a better light than that of the old companies?

"You, however, seem to court a discussion. I wish it were on the *truth*. Will you allow me to ask, What you mean by 'mutual rights, duties, and interests'? I positively cannot conjecture; but, having fastened yourselves to the car of popularity, in which Mr. Charles Pearson rides (of course *not* at the expense of the citizens), you are obliged to bow to the word of the 'Patriot,' and you ask for mutual rights! duties!! and interests!!! Do you suppose the citizens to be children? They can enforce their 'rights' without your aid—perform their 'duties' without your teaching—and, as for their 'interests,' if they do not know how to protect them, they had better consult Mr. C. Pearson at his 'midnight oil'—that is, I suppose, after dinner, when funny things are done, and many things promised.

"You consider that your shareholders have a right to expect from the directors (yourselves) some explanation of the '*uses*' of the bill, the '*probability*' and '*expense*' of procuring it. I quite agree in this right of the shareholders, which they enjoy, apparently, *without* any act of parliament.

"The '*use*' is what? You *are* incorporated; you *have* your capital subscribed; you *have* your works; you *have* all your pipes laid throughout the City; you *have destroyed* the beauty of the pavement all over London, and given rise to much heavier rates for future repairs. You *have*—so you are advised—a *limited responsibility;* for what, then, do you need an act of Parliament? I can easily fancy a shareholder asking this simple question, and being told ——. I mean as to the '*use*' of the act of Parliament.

"As to the 'probability' and 'expense' of procuring it—we may infer things *to be* from events that *have* occurred. You have been beaten twice on the previous occasions, and paid, you admit, nearly £17,000!!! You had on each of these occasions some appearance of *necessity* for an act of Parliament; now you have none, and still you will have as hearty an opposition as ever the energy of an English tradesman offered to his competitor; that is, without resorting to '*lies*,' for we are not skilled in the dealing out of this ware. We do not know how to get in a moment 10,000 citizens!!! to do that which they never thought of before—to overawe a public body—or how to get at 1s. a head consumers of gas to contract for supplies? Do you really, as gentlemen, sanction this? Is this fair trading? Is this the teaching of the City solicitor? Surely Mr. Dakin, Mr. Bradbury, Mr. Delane, &c., do not approve of such proceedings? Neither can I believe they have or would sanction Mr. Charles Pearson, or any other person, calling my clients or myself 'dishonest,' for would *you* approve a placard placed before your respective doors stating 'This Mr. Dakin sells adulterated drugs, uses false measures, and particularly to the poor, who are obliged to come to him?' Or Mr. Bradbury, or Mr. Bennoch, or others, a placard stating 'this *honest* man sells you a piece of goods of the same nominal length as the rest of the trade, but your correspondent in India will find several yards short,' &c. &c.? And yet this is the mode you *appear* to have sanctioned; this is the honest and fair dealing to which you have manacled yourselves, and permitted Mr. Charles Pearson to drive the car, and, let the dirt be ever so great, you must follow after it. I pity you, for you have lost your money. I wish this were *all*. You sent a deputation to meet the deputations of the old companies, and violated the agreement under which the meeting took place. The report of that meeting, published by yourselves, has been branded in print with falsehood, and this is not denied. You have charged the City Gas Company with supplying false meters, and you *know* that they did not furnish any, but that all were provided by the customers themselves. It is bad enough to tell the lie; it is more so to tell it with a view to destroy a tradesman; it is aggravated when that tradesman is a competitor, who never injured you, but whom you are seeking to supplant and supersede for your own benefit. Is this the conduct of respectable traders—merchants of London? Competition is, in England, the soul of activity; but we are not yet quite so depraved as to admit wilful falsehood as an ingredient of fair competition; and if you can continue directors in this company and still do such dirty work I trust the citizens will cry shame upon you. Alderman after alderman has wisely retired; but Mr. Dakin, Mr. Bradbury, Mr. Bennoch, dare not. So much for the tyranny of *liberty*. You have *fraternized* with Mr. Charles Pearson, and, I suppose, have consented to *equality;* he with yourselves, or you with him.

"It is true, I compared the reductions of price made by the old companies, as concessions made to highway robbers. I did it deliberately, and on reconsideration, I cannot alter it. Mr. Charles Pearson and Mr. Croll caused such attacks to be made upon the old companies, that they thought it better rather to sacrifice a large part of their property than lose the whole. If I were in the *merciful* hands of these gentlemen myself, I should, unhesitatingly do the same—the reduction was not made under a conviction of its propriety.

"I am charged with having branded the shareholders as insolvents. I deny it. I stated that *some* were, and I am prepared to *prove* it.

"I willingly bear the odium Mr. Charles Peason may heap upon *me* as the cause of the expenses incurred, even although I did but follow instructions. Recommend I did, and do, and ever shall, the most determined opposition to persons who, under *pretence* of supplying the citizens with cheaper and better gas, wilfully belie and malign my clients, and I feel that it would be compromising my character as a man were I not to advise opposition to such conduct.

"The confederacy alleged never existed, and you know it never did; I invited, as I have a right to do, parties to put their local members in possession of the real facts of our case.

"This is an inquiry Mr. Charles Pearson dreaded to face, and even when his own witnesses (such was their palpable failure) were left uncontradicted, their application of your company was rejected. You have referred to the old companies not calling witnesses as proof that they could not refute yours. You know, every one of you, that this is a most dishonest repre-

sentation. The old companies felt that the falsehoods were too thin to require explanation—much less contradiction.

"Pray carry out your threat, and make an appeal to the citizens for protection against the opposition—it is a good opportunity—there is about time enough to get up your circulars and your clubs, and your standing staff, to maintain the popularity of Mr. Charles Pearson; and pray resort to the respectable trade of agitators previously to St. Thomas'-day! Be sure you increase the votes of thanks to Mr. Charles Pearson at the Ward-motes!!—he may need them in the committees at Guildhall, when discharging his onerous duties, or for such (if any) as may accidentally have been left undone. As to the history of my clients, when they want a *truthful* historian, they may apply to you, gentlemen, but we are not likely to trespass on the 'midnight-oil' of Mr. Charles Pearson; at present, however, I must content myself with saying that much of the comparison is altogether false, and what there is of truth is generally so garbled as to be unworthy of yourselves, and such as I think no one of you would venture to write, or individually to publish.

"I do not know the quantity of gas you are manufacturing, but I unhesitatingly deny that you are distributing to consumers more gas than my clients are manufacturing. I believe the one half of what you manufacture does *not* go to the customer, but is lost in leakage, &c. &c. This is an accomplishment my clients do not aim at!

"The cuckoo-note of 'monopoly' is as absurd as it is false; for, by the watchfulness of the Commissioners of Sewers, the citizens enjoyed all the benefit of competition without its inconveniences until this year; and I fancy the citizens have had a pretty good taste of its pleasures; and for the next three years, even though the contests were to cease to-day, will the pavements of the streets warn the rate-payers of their folly.

"It is to be regretted that while you compare (of course for the benefit of my clients only) the conduct of your company with theirs, you do not allude to the 'truth' and 'want of truth.'

"As to your statement of my expecting to destroy your company, I repeat that I have never said so at the Guildhall justice-room or elsewhere; but I *have* said, and still maintain, that the possessors of £600,000 capital embarked in gas making, cannot abandon it at the mere waive of Mr. Charles Pearson's wand—it was a necessary consequence, and must continue to be so, that each company will endeavour to sustain its own trade, and in the contest, notwithstanding falsehoods and unfair trading, the result must eventually be the ruin of the weaker of the contending companies.

"If it be still pretended by you that you seek to secure cheap gas to the citizens, and 'some mutual rights, duties, and interests,' though you do not define them—cannot you secure them without further expense? I have attended every meeting which Mr. C. Pearson has desired. I have seriously endeavoured to understand him and his suggestion, but everything seemed in *his* mind to run into an amalgamation, by which the old companies were to be swallowed in by his company.

"The citizens have gas now cheaper than any other part of the metropolis—this, my clients have offered to secure in any way the Commissioners of Sewers will dictate—and I am sure they (my clients) would be ready at any time to make a reasonable arrangement with your company; not, however, leaving it to the '*honour*' of Mr. Charles Pearson to define. But if Mr. Bradbury and Mr Hardwick, will meet Mr. Wigg, Mr. Gray, and myself, fully *authorized* to *conclude* arrangements; and in the event of difference, to refer it to an umpire, to be named before the meeting proceeds to business, I am prepared to recommend such a course; and this, not only as between the companies, but also to secure to the public (that is the consumers) what is due to them. In your individual capacities, you would each deem this an honourable and business like offer, and meet it by immediate acquiescence—but will you, can you thus act, while under the influence of Mr. Charles Pearson?

"I am, gentlemen, your obedient servant,
TIMOTHY TYRRELL."

"The Directors of the Great Central Gas
Consumers' Company, 28, Coleman-street."

Mr. C. PEARSON replied at considerable length to a variety of observations in the answer sent on the part of the City of London Company.

Mr. HARDWICK then read the petition; after which

Mr. PEARSON, in reply to a question, stated that a bill was necessary for a variety of reasons. It was desirable, for example, to have the company's meters protected against distress, or other circumstances; and that the power of the directors should be placed under certain limitations.

It was then moved by Mr. HALL and seconded by Mr. LARBEY, "That the directors be and they are hereby authorized to apply for and prosecute a bill in Parliament to give additional powers to the company, and for other purposes; and that the company do petition the Court of Common Council respectfully requesting the court to petition Parliament in favour of the bill."

This resolution, after a short discussion, was unanimously adopted.

The petition to the Common Council was then agreed to, and the proceedings terminated.

ASSOCIATION OF GAS FITTERS,

96, ST. MARTIN'S-LANE, LONDON.

TUESDAY, Nov. 12.

Mr. DEPRIES presided, and, on taking the chair, expressed, in very complimentary terms, the thanks of the association to the editor of the JOURNAL OF GAS LIGHTING, for the able manner in which he had noticed their proceedings.

Mr. BIDDLE submitted to the inspection of the members his patent self-regulating gas burner. The value of the invention, however, could neither be explained or tested, in consequence of the gas fittings of the room not being in a condition to afford the requisite amount of pressure. The invention was accordingly submitted to a committee of practical men who are to test its utility, and report on its merits at the next meeting.

Mr. KELLAWAY, in accordance with previous notice, complained that he had been dismissed from doing the work of the Oriental Club.

This complaint gave rise to a lengthened conversation, after which the following resolution was unanimously agreed to, and the secretary was directed to communicate it to the committee of the Chartered Gas Company:—

"That Mr. Kellaway having stated to the society the cause of his complaint against the chief inspector of your company, and which complaint we, the Gas-fitters' Society, believe to be well founded; this society, although founded for the purpose of mutual instruction, and to advance the progress of gas lighting, cannot let this matter pass unnoticed. We trust the directors of the Chartered Gas Company will exercise a proper control over their officers to prevent improper interference on the part of any servant of the company in favour of any individual tradesman, a course they consider at all times highly reprehensible."

The meeting then adjourned.

COOKING BY GAS.—Mr. James Sharp, the intelligent manager of the Southampton Gas Works, delivered a lecture on "Gastronomy" at the Polytechnic Institution of that town on the 4th inst., before an assembly of 800 persons, of whom 120 afterwards sat down to a substantial supper, cooked by gas on the lecturer's table before the audience. The bill of fare contained—Roasts: 34 lb. of beef, 15 lb. of mutton, 12 lb. of pork. Boiled and steamed: 24 lb. of mutton, a cod fish, 4 fowls, 8 plum puddings, vegetables, &c., with baked pies and tarts, the whole having been cooked with an expenditure of 156 feet of gas, the dripping collected being valued at 2s. The lecturer demonstrated the scientific principles upon which his apparatus was constructed and the heat applied, going into the theory of radiation, and showing how the greatest effect could be produced by the smallest consumption of fuel. The novelty of the evening's entertainment not only excited the intellectual and digestive organs, but gratified them at the same time.

GAS LIGHTING IN ITALY.—A correspondent informs us that the gas works of Bologna and Modena, upon which upwards of £30,000 was expended by the proprietors, have been lately sold for £20,000, payable by instalments spread over 18 years. Even on these terms the purchase is a bold one, in the face of a constantly accruing loss in carrying the works on. Another correspondent enquires what has become of the £7750 subscribed in England towards the capital required for the lighting of Rome with gas? We presume it has been appropriated to the payment of the £9000 and odd, for which the contract was purchased, and that the balance will be claimed some day or other.

FRAUDS ON GAS COMPANIES.—John Miller, auctioneer, was charged by Mr. Cox, secretary to the Sunderland Corporation Gas Company, with burning gas belonging to the above company, from the 1st of August to the 6th of November, 1850, in a fraudulent manner, whereby he had rendered himself liable to a penalty of £24. Mr. A. J. Moore appeared for the prosecution, and Mr. Potts for the defence. It appears that defendant had had the gas in his dwelling-house for some time, but that having fallen into £2. 7s. arrears with the Gas Company about a year ago, he agreed to cease burning till the bill was paid, but on one of the workmen going lately to take away the meter, he found it detached, and another pipe fixed in the service pipe (by means of a joint made with putty) and conveyed to the burner in the house, whereby he had been consuming the gas without passing through the meter, and also without the knowledge of the company. There is a clause in the act of the company which renders any person liable to a fine of £2 per night for burning the gas of the company in this manner; and the officers of the company being able to prove that the defendant had burnt it at least for twelve nights, he had consequently rendered himself liable to a penalty of £24. Mr. Potts, on behalf of his client, threw himself on the mercy of the company, stating that it was the son of the defendant who had altered the pipe without the knowledge of his father. Mr. Moore said he would not press for the larger penalty, but consent that the defendant be fined in the sum of five pounds. Mr. Simpson said he hoped that this would be a caution for the future to all persons who should offend in a similar manner; for to say the the least of it it was neither more nor less than robbery. Fined £5 and costs. In default of payment, he was committed for one month's imprisonment.

LUTTERWORTH GAS WORKS.—The inhabitants of Lutterworth have, after fifteen years' hesitation, decided upon lighting their town with gas, and appointed Mr. T. Sharp, of Northampton, to be their engineer. The contract for the apparatus and mains has been taken by Messrs. G. and S. Cutler, of London.

REDUCTIONS in the prices of gas have just been announced by the gas companies in the following towns:—

Winchester, from	8s.	per 1000 feet to	7s.
Gosport,	8s. 6d.	,,	6s. 6d.
Northampton,	6s. 3d.	,,	5s., with 10 per cent.

discount to consumers of 250,000 feet, yearly, and upwards.

KENSALL GREEN (WESTERN) GAS WORKS.—The *Expositor* of the 7th inst. contains a view of these new works, and well executed engravings of the retorts, "regenerators," "mechanical precipitators," "ammoniacal filtering towers," and other details of the unique apparatus connected therewith. The whole displays great ingenuity, but will we suspect not find many imitators.

BRITISH AND FOREIGN GAS-LIGHT AND METER COMPANY.—The company was established in 1846, in Gresham-street, for carrying out improvements in gas-lighting and gas-meters, and continued up to 1848; and in April last, at a meeting of the shareholders, it was resolved to bring it under the Winding-up Act. About 650 shares out of 1000 of £25 each were taken, and a deposit of £1. 5s. paid on them. The debts, which were compromised by payments on the part of the directors, amounted to £600. Mr. Goodchap has been appointed official manager to wind up this company.

UNIVERSAL GAS-LIGHT COMPANY.—Sir George Rose has allowed the claim of Mr. Fessenmeyer, the late solicitor of the company, for £1070, subject to the taxation of Mr. Harding, the official manager, under the Joint Stock Company's Winding-up Act, if he had a right to tax, which is to be determined by petition to the Vice-Chancellor. The claim of the executors of Mr. Grenaway, the late secretary of the company, for £67, was allowed.

Share List.

THE PRICES QUOTED ARE THOSE AT WHICH THE LAST SALES HAVE BEEN MADE.

The Companies whose names are printed in italic type are incorporated by Act of Parliament.

Number of Shares issued.	Amount per Share	Name of Company.	Amount paid up per Share	Dividend per Cent. per Ann.	Price.
	£	**ENGLAND.**	£ s. d	£ s. d	£ s. d
		Aberdare			
		Abergavenny			
		Aberystwith			
		Abingdon			
		Accrington £7000		5 0 0	
		Alcester			
		Alford, Lincolnsh.			
		Alfreton			
		Alnwick			
		Alston Moor			
250	10	Alton	10 0 0	5 0 0	10 0 0
800	5	Altrincham	5 0 0		
		Amlwch			
160	10	Ampthill	10 0 0	5 0 0	10 0 0
350	10	Andover	10 0 0	6 0 0	11 0 0
		Appleby			
		Arundel			
		Ashbourn, Derby			
		Ashburton			
		Ashby-de-la-Zouch			
		Ashford, Kent			
		Ashton-under-Line £39,700		10 0 0	
		Atherstone			
		Axminster			
225	20	Aylesbury	20 0 0	5 0 0	21 0 0
		Aylsham, Norfolk			
		Bacup, Yorkshire			
		Bakewell			
		Baldock			
140	25	Banbury	25 0 0		
		Bangor			
500	5	Barking, Essex	4 10 0	5 11 0	5 0 0
250	10	Barnard Castle	10 0 0	5 10 0	10 15 0
		Barnet			
		Barnsley £6000		7 10 0	
100	20	Barnstaple	20 0 0	7 10 0	25 0 0
		Barton			
120	25	Basingstoke	25 0 0	8 0 0	28 0 0
2400	20	*Bath*	16 0 0	6 0 0	25 to 30
		Battle £2000		6 0 0	
56	26½	Bawtry	26 10 0	5 0 0	25 0 0
		Beaumaris			
		Beccles, Bungay, and Lowestoft			
		Bedford			
		Bedworth			
		Belford			
		Bedale, Yorkshire			
		Belper			
		Beminster			
		Berkhempstead			
700	5½	Berwick-on-Tweed	5 10 0	6 8 0	5 15 0
		Beverley			
		Bewdley			
280	10	Bideford	10 0 0	6 0 0	10 10 0
		Biggleswade			
160	10	Bicester	10 0 0	5 0 0	10 0 0
		Bilston £15,100		6 10 0	
		Billericay			
		Bingley £7400		4 0 0	
		Birkenhead and Claughton £70,000	35 0 0	3 0 0	32 to 34
2400	50	*Birmingham and Staffordshire*	50 0 0	8 0 0	84 to 86
	25	*Ditto*, new shares	7 10 0	8 0 0	12 0 0
704	75	*Birmingham*	75 0 0	9 0 0	127 to 129
		Bishop's Auckland			
		Bishop's Stortford			
		Blackburn £30,000		10 0 0	
		Blandford			
		Blythe			
		Bodmin			
		Bognor			
		Bolton £38,582		9 19 5	
		Boroughbridge			
		Boston £8000		10 0 0	
200	10	Bourn	10 0 0	5 0 0	
		Brackley			
		Bradford, Wilts			
		Bradford, Yorksh.			
		" £45,000		9 10 0	
		Brampton, Cumb.			
		Brandon, Suffolk			
		Brecon			
		Bridge-end, Glam.			
		Brierly Hill			
2250	20	*Brighton*	20 0 0	5 0 0	14 to 15
1125	20	" new shares	16 0 0	5 0 0	
		Brighton and Hove £50,276			
4250	20	*Bristol*	20 0 0	9 0 0	37 0 0
1725	25	*Bristol and Clifton*	25 0 0	6 0 0	25 0 0
		Brixham			
		Braintree			
750	50	*Brentford*	50 0 0	6 0 0	44 to 46
800	25	" new shares	11 0 0	6 0 0	11 0 0
		Brentwood			
		Bridgwater £6000		5 0 0	
400	10	Bridlington	10 0 0		8 0 0
		Bridport			
		Brigg			
		Broadstairs			
100	50	Bromley, Kent	50 0 0	6 0 0	52 10 0
		Bromsgrove			
		Broughton			
120	10	Bruton	10 0 0	4 0 0	8 0 0
100	25	Buckingham	25 0 0	5 0 0	25 0 0
		Bungay (see Beccles)			
		Burford			
		Burnley £19,946		4 10 2	
		Burslem			
		Burton-on-Trent			
		Bury St. Edmund's £10,500		5 0 0	
		Bury, Lanc. £6570			
		Buxton			
		Callington			
		Calne, Wilts			
		Camborne			
		Cambridge £34,560		9 0 0	
240	50	*Canterbury* Gas and Water	50 0 0	6 0 0	57 to 58
240	25	*Ditto*, second issue	25 0 0	6 0 0	28 to 29
		Cardiff £12,000		7 10 0	
		Carmarthen			
		Chapel on the Frith			
		Chard			
		Chatham (see Rochester)			
		Chatteris			
		Cheadle			
		Chelmsford			
		Cheltenham £18,732		8 10 0	
		Chepstow			
		Chertsey			
230	10	Chesham, Bucks	10 0 0		
		Chester			
		Chester-le-Street			
		Chesterfield £13,123		4 17 6	
240	25	Chichester	25 0 0	6 0 0	30 0 0
		Chippenham			
		Chipping Norton			
		Chirk			
		Chorley			
		Chudleigh			
		Cirencester			
		Clifton (Bristol and Clifton)			
		Cleckheaton, York.			
		Clitheroe			
		Cockermouth			
		Colchester			
		Collumpton			
		Colne, Lancashire			
		Coleford, Gloucest.			
		Coggeshall			
		Congleton £5000		5 0 0	
		Cowbridge			
800	25	*Coventry*	25 0 0	6 0 0	20 0 0
		Cowes			
		Crewkerne			
		Croydon ... £20,000		5 0 0	
		Cranbrook ... £1900		5 0 0	
		Crediton			
		Crewe, Cheshire			
		Cricklade			
		Darlaston			
		Darlington			
250	20	Dartford	20 0 0	7 10 0	27 0 0
		Dartmouth			
125	20	Daventry	20 0 0	6 0 0	24 8 0
		Dawley, Shrop.			
		Dawlish			
500	6	Denbigh	6 0 0	5 0 0	6 0 0
820	10	Deptford	10 0 0	5 0 0	4 10 0
325	50	*Derby*	50 0 0	10 0 0	
90	20	Dereham (East)	20 0 0	4 10 0	
1000	5	*Dewsbury*	5 0 0	10 0 0	8 12 6
		Devizes			
4000	5	*Devonport*	5 0 0	6 0 0	6 5 0
		Doncaster			
280	25	Dorchester	25 0 0	5 0 0	25 0 0
120	25	Dorking	20 10 0	5 0 0	21 10 0
		Douglas, Isle of M.			
209	56¼	*Dover*	56 10 0	4 15 4	55 0 0
		Downham			
		Driffield			
		Droitwich			
600	20	*Dudley*	20 0 0	4 0 0	15 to 16
		Dunmow			
		Dunstable			
		Durham			
276	9	Dursley, Gloster	9 0 0	5 10 0	8 0 0
		East Grinstead			
		Elland			
		Ellesmere			
		Enfield			
300	19	Epsom	19 0 0		
		Evesham			
		Exeter £40,000		10 0 0	
		Exmouth			
		Eye, Suffolk			
64	25	Fakenham	25 0 0	5 0 0	25 0 0
		Falmouth			
		Fareham			
120	25	Farnham	25 0 0	10 0 0	42 0 0
		Farringdon			
		Faversham			
		Ferrybridge			
		Fleetwood			
		Folkestone			
		Fowey			
240	5	Framlingham	3 10 0		
		Frome			
		Garstang			
		Gillingham, Dorset			
		Glastonbury			
		Glossop ... £10,000		9 0 0	
		Gloucester £25,000		7 10 0	
		Gomersal			
		Godalming			
		Gosport			
		Grantham			
		Gravesend			
1000	10	*Great Grimsby*	6 10 0	8 0 0	8 5 0
	25	Guildford	25 0 0	4 0 0	20 0 0
		Guisborough			
		Hadleigh			
		Hales Owen			
300	6	Halesworth	6 0 0	7 10 0	5 10 0
		Halifax £15,000		10 0 0	
		Halstead			
		Hampton Court			
		Harrogate £10,000		5 0 0	
		Hartlepool £15,137		7 10 0	
		Haslingden, Lansh.			
330	50	Hastings and St. Leonard's	50 0 0	6 0 0	60 0 0
		Haverfordwest			
		Haverhill			
		Haworth, Yorks.			
		Hayle			
		Helstone			
		Hemel Hempstead			
300	10	Henley-on-Thams.	10 0 0		
		Hereford £5300		4 0 0	
		Herne Bay			
270	10	Hexham	10 0 0	7 0 0	12 0 0
		Heywood £10,000		5 0 0	
		Highworth (Wilts)			
230	10	Hinckley	10 0 0	5 0 0	7 0 0
		Hindley, Lancash.			
		Hitchen			
		Hythe			
		Hoddesden			
		Holbeach			
		Holmfirth £8880		3 10 0	
		Holyhead			
		Holywell (see British Provincial)			
		Honiton			
		Horncastle			
10		Houghton-le-Sprg.	10 0 0	8 0 0	
		Horsham			
		Howden			
		Hull, Sculcoats (see British Provin.)			
		Hull, £11,712. 10s.		5 0 0	
210	10	Hungerford	10 0 0	5 0 0	10 0 0
		Huddersfield			
520	5	High Wycombe	5 0 0		5 0 0
		Ilminster			
		Ilford			
		Ilfracombe			
		Ironbridge			
1400	10	*Ipswich*	10 0 0	7 10 0	15 0 0
1400	10	" new shares	5 0 0	7 10 0	
800	25	*Isle of Thanet* (Ramsgate&Mar.)	20 0 0	5 0 0	20 to 21
		Kendal £9100		8 15 0	
		Kenilworth			
		Keswick			
	25	0 0 Kettering		5 0 0	25 0 0
100	25	*Kiddermins.* £10000		5 0 0	
		King's Langley			
		Kington, Hereford			
		Kirkby Lonsdale			
		Kirkham, nr. Preston			
		Knutsford			
		Lancaster			
		Llanelly £3000		5 0 0	
		Llandovery			
		Leamington Priors £22,500		6 0 0	
		Leatherhead			
		Ledbury			
		Leeds Old Comp. old stk., £60,300		10 0 0	
		new " £23,775		6 0 0	
		Leeds New £60,000		10 0 0	
		Leek			
		Leicester ... £36,230		7 0 0	
		Leigh			
125	20	Leighton Buzzard	20 0	5 0 0	
		Leominster			
		Leyburn, Yorksh.			
		Liskeard			
330	25	Lewes	25 0 0	5 0 0	23 0 0
		Lincoln £8000		10 0 0	
		Leyland, Lancash.			
		Littlehampton			
250	20	Lichfield	20 0 0	7 10 0	27 10 0
		Liverpool United	100 0 0	9 0 0	174 to 176
		" ¼ sh.	25 0 0	9 0 0	43¼ to 43½
		Langport			
5000	40	London Comps.—*British*	18 0 0	5 0 0	12 to 13
		" debentures £46,300		4 0 0	
5000	20	" Provincial—(Gloucester, Holywell, Hull, Norwich, Stoke, Trowbridg)	20 0 0	7 0 0	17 to 19
	20	" Prov., new	6 0 0	7 0 0	4 to 5
	25	*Commercial*	25 0 0	6 0 0	23 to 24
	25	" new shres	10 0 0	6 0 0	¼ dis.
	25	"	2 10 0	6 0 0	¼ dis.
12,000	50	*Chartered*	50 0 0	6 0 0	45 to 47
6000	50	" new shares	10 0 0	6 0 0	9 to 9½
2000	150	*City of London*	150 0 0	5 0 0	160 0 0
4000	50	*Equitable*	50 0 0	2 10 0	25 to 28
		" debentures £51,000			
10,000	20	European—(Amiens, Boulogne, Caen, Havre, Nantes, and Rouen)	20 0 0	5 0 0	9 to 11
		" do. new			2 to 2¼

Number of Shares issued.	Amount per Share £	Name of Company.	Amount paid up per Share £ s. d	Dividend per Cent. per Ann. £ s. d	Price. £ s. d
15,000	10	Gt.Cntl.Consumers	10 0 0		
8000	50	*Impl.Continental* —(Amsterdam, Aix-la-Chapelle Antwerp, Berlin, Bordeaux, Brussels, Cologne, Frankft., Ghent, Haarlem Hanover, Lille, Marseilles, Rotterdam, Toulouse, Vienna)	42 0 0		40 to 45
7000	50	„ new shares	41 0 0		50 to 55
	50	„ third issue	42 10 0		40 to 45
10,000	50	*Imperial*	50 0 0	6 0 0	71 to 73
3000	50	„ new shares	35 0 0	6 0 0	50 to 52
		„ debentures £50,500			
4000	40	*Independent*	40 0 0	6 0 0	46 to 47
8000	25	*London*	25 0 0		7 to 8
6000	25	„ preference	25 0 0	6 0 0	18 to 20
		„ debentures £150,000			
9000	50	*Phœnix*	49 0 0	4 10 0	27 to 29
1000	100	*Ratcliff*	90 0 0	5 0 0	58 to 60
4000	25	*South Metrop.*	25 0 0	6 0 0	22 to 23
9000	50	UnitedGeneral—(Cork, Dublin, Limerick)	50 0 0	2 0 0	15 to 15½
12,500	20	Western	18 0 0		7 0 0
		Lostwithiel			
		Loughborough			
240	25	*Louth*	25 0 0	6 0 0	26 10 0
		Lowestoft (see Beccles)			
611	5	Ludlow Union	5 0 0	6 0 0	5 0 0
		Luton			
		Lutterworth			
		Lyme Regis			
		Lymington			
		Malmesbury			
		Macclesfield 32,000*l*		3 15 0	
		Maidenhead			
250	50	Maidstone	50 0 0	10 0 0	100 0 0
		Maldon			
		Marlborough			
		Malton (New)			
		Malvern			
		Manningtree			
		Mansfield £5000		10 0 0	
		March			
		Margate (see I. of T.			
		Market Deeping			
132	25	Market Harboro'	25 0 0	6 0 0	30 0 0
		Market Raisin			
		Market Weighton			
		Marlow			
370	10	Maryport	10 0 0	6 0 0	12 0 0
		Melksham			
		Melton Mowbray			
		Merthyr Tydvil			
		Mere			
		Middleton £9039		5 0 0	
		Midsummer Norton			
		Middlesboro'			
		Mildenhall			
		Mitcham			
		Mold			
700	10	Monmouth Gas and Water	10 0 0	5 0 0	
		Monk Wearmouth			
		Moreton in Marsh			
		Morley			
		Mottram			
		Nantwich			
		Neath			
		Needham Market			
		Newark £5000		10 0 0	
250	20	Newbury	20 0 0	5 0 0	20 0 0
13,000	5	Newcastle & Gateshead Union	5 0 0	8 0 0	6 12 6
		Newcastle-under-Lyne £6200		4 0 0	
600	5	Newmarket	5 0 0	6 0 0	5 0 0
		Newnham, Glost.			
		Newent			
		New Mills & Hayfield £2115			
		Newport, M. £11720		8 0 0	
320	50	*Newport, Isle of W.*	38 0 0	4 0 0	19 to 20
		Newport Pagnell			
		Newport, Salop			
		Newton Abbot			
		Newton, Lanc.			
		Northallerton			
		North Walsham			
542	20	*Northampton*	18 0 0	10 0 0	27 0 0
		Northwich			
		Norwich (see British Pro. £40,000		7 0 0	
900	50	*Nottingham*	50 0 0	10 0 0	
900	50	New shares		10 0 0	
		Nuneaton			
		Oakham			
		Oakhampton			
200	10	Odiham, Hants	10 0 0	3 10 0	10 0 0
		Oldham			
		Ongar			
		Ormskirk			
		Otley, Yorkshire			
		Oundle			
		Oxford £18,000		9 10 0	
		Over Darwen £8000		5 0 0	
		Padstow			
		Pately Bridge, Yrk.			
250	20	Penrith	15 0 0	6 10 0	21 0 0
		Penryn			
		Penzance			
200	10	Petworth	10 0 0	9 10 0	12 0 0
		Pickering			
300	10	*Plymouth & Stonehouse*	10 0 0	6 0 0	11 0 0
		Pocklington			
		Pontefract			
		Pontypridd			
400	10	Poole	10 0 0	5 0 0	10 0 0
		Port Madoc			
600	50	*Portsea Island*	53 0 0	5 0 0	45 to 47
400	10	Prescott	9 0 0	4 13 4	7 0 0
		Preston £52,500		10 0 0	
		Pwllheli			
		Pontypool			
		Pudsey £12,000		5 0 0	
		Radcliff and Pilkington £9000		4 12 10	
		Ramsay, I. of Man			
		Ramsgate (see Isle of Thanet)			
		Ravenglass			
1000	10	*Reading*	10 0 0	3 0 0	7 0 0
500	20	*Reading Union*	20 0 0	6 0 0	17 0 0
		Redditch			
		Redruth			
		Reigate			
		Retford (East)			
		Rhyl			
		Richmond (Surrey)			
		Ripon			
		Rochester and Chatham £20,000		6 0 0	
		Rochford			
		Rockingham			
		Romford			
		Ross			
		Rotherham £6100		10 0 0	
		Royston			
		Ruabon			
		Rugby			
		Rugeley			
		Ruthin			
		Runcorn ... £11,000		7 10 0	
500	10	Ryde	10 0 0	6 0 0	12 0 0
		Rye			
		Romsey			
		Saddleworth			
225	20	Saffron Walden	20 0 0	3 15 0	19 0 0
		St. Austel			
		St. Asaph			
		St. Colomb			
		St. Helen's £7500		7 10 0	
		St. Helier's (Jersey)			
		St. Ives, Hunting.			
		St. Ives, Cornwall			
250	10	St. Neot's	10 0 0	8 0 0	12 0 0
		St. Peter's Port, (Guernsey)			
320	25	Salisbury	25 0 0	6 0 0	28 to 30
		Sandbach			
140	10	Saxmundham	10 0 0	5 0 0	10 0 0
		Scarborough			
		Seaham Harbour			
		Selby			
		Settle			
290	10	Sevenoaks	10 0 0	5 0 0	10 0 0
		Shaftesbury			
5400	25	*Sheffield United*	24 0 0	8 6 8	32 0 0
		Shelton, Potteries (see Brit. Prov.)			
		Shepton Mallet			
		Sherborne			
2914	5	Shields, North (Tynemouth)	5 0 0	3 0 0	5 0 0
		Shields (South)			
		Shiffnal, Salop			
1000	5	*Shipley*	5 0 0	6 0 0	5 10 0
		Shipston-on-Stour			
		Shoreham			
		Shrewsbury £10,000		7 0 0	
400	10	Skipton	10 0 0	4 0 0	11 0 0
		Sleaford			
250	10	Slough	10 0 0		
		Snaith			
		Soham			
		Southwold			
		South Molton			
1000	50	*Southampton*	32 0 0	5 0 0	
		Sowerby, Yorksh.			
		Stretford			
		Stokesly			
		Stafford £10,000		5 0 0	
		Staines and Egham			
		Staley Bridge £15,000		10 0 0	
		Stamford £11,250		3 0 0	
		Stockton-on-Tees £7980		9 5 0	
840	9½	Stockton, New	9 10 0	9 0 0	8 0 0
960	10	Stoke-upon-Trent	10 0 0	5 10 0	10 0 0
500	10	„ new shares	4 0 0	5 10 0	10 0 0
		Stone, Stafford			
		Stoney Stratford			
		Stourbridge			
		Stowmarket			
150	20	Stratford-on-Avon	30 0 0	7 10 0	30 0 0
		Stroud			
169	10	Swaffham	10 0 0	5 0 0	5 10 0
		Swansea £9000			
		Sudbury			
		Sunderland, old			
6400	5	*Sunderland*, new	5 0 0		
		Sutton			
		Swindon			
2800	5	*Taunton*	5 0 0	None	2 10 0
		Tadcaster			
		Tamworth			
		Tavistock			
		Teignmouth			
		Tenbury			
		Tenby			
		Tenterden £2000		2 10 0	
		Tetbury, Gloster			
		Tewkesbury			
		Thame			
		Thetford			
		Thirsk			
		Thornbury			
		Thorne			
		Tiverton			
670	5	Todmorden	3 0 6		
		Torquay			
		Torrington, Devon			
		Totnes			
		Totnes and Bridgetown Consumers			
4000	5	Tottenham	3 10 0	6 0 0	3 0 0
		Towcester			
		Tring			
		Trowbridge (see British Provin.)			
75	50	Truro	50 0 0	2 0 0	
		Tunbridge			
		Tunbridge Wells			
		Ulverston			
		Uppingham			
240	5	Upton-on-Severn	5 0 0	5 0 0	5 0 0
		Usk, Monmouth			
		Uttoxeter			
		Uxbridge			
1000	25	*Wakefield*, old capi	25 0 0	6 0 0	25 0 0
1600	5	„ new „	5 0 0	6 0 0	5 0 0
300	10	Wallingford	10 0 0	5 0 0	8 0 0
		Wandsworth			
		Wantage			
		Warrington £23304		10 0 0	
100	10	Wareham	10 0 0	3 10 0	8 0 0
120	25	Warminster	25 0 0	5 0 0	27 0 0
		Warth			
		Warwick £15,000		6 0 0	
		Watford			
		Welchpool, Mntgy.			
		Wellingborough			
		Wellington, Salop			
		Wellington, Smrst.			
		Wells, Smrst. £5000		7 10 0	
		Westbury			
		Weston-sup.-Mare			
2000	5	West Ham	5 0 0	6 0 0	5 0 0
		Whitby			
		Whitehaven			
		Whittlesea			
		Wigan £10,160		12 10 0	
		Willenhall			
		Winchelsea			
		Winslow			
240	10	Wimborne Minster	10 0 0		
		Wincanton			
360	50	Winchester	50 0 0	6 0 0	
900	12½	Windsor	12 10 0	10 0 0	23 0 0
		Witham			
		Witney			
4448	10	*Wolverhampton*	10 0 0	7 0 0	15 0 0
		Woburn			
210	10	Wokingham	10 0 0		10 0 0
		Woodbridge			
		Wooler			
		Wotton-un.-Edge			
		Worcester £29,000		8 0 0	
		Workington			
		Worksop and Radford			
		Wirksworth			
		Worthing			
		Wrexham			
		Woolwich			
		Woolwich Consms.			
		Woolwich (North)			
		Wymondham			
		Yarm			
795	20	Yarmouth	20 0 0		15½ to 16½
		Yeadon, near Leeds			
		Yeovil			
		York Untd. £35,000		7 0 0	
		SCOTLAND.			
		Aberdeen			
		Airdrie			
		Alloa			
		Annan			
		Anstruther			
		Ardrossan			
550	20	Arbroath	20 0 0	7 10 0	7 10 0
		Auchterarder			
750	2	Auchtermuchty	2 0 0	6 0 0	2 10 0
		Ayr, old			
		Ditto, new			
		Banff			
		Barrhead			
		Bathgate			
		Beith			
		Bervie			
		Biggar			
		Blairgowrie			
300	6	Borrowstowness	6 0 0	5 0 0	8 0 0
		Brechin			
		Bridge of Allan			
		Broughty Ferry			
		Burntisland			
		Callen			
		Campbelton			
		Clackmannan			
		Coatbridge			
		Coldstream			
		Collinsburgh			
		Crieff			
		Crail, Fife			
		Cumbernauld			
		Cumnock			
600	5	Cupar Angus	5 0 0	6 0 0	5 10 0
250	10	Cupar Fife	10 0 0	7 10 0	14 0 0
		Dalkeith			
		Dingwall			
		Dornoch			
		Douglas			
		Dumbarton			
400	20	Dumfries	14 0 0	5 0 0	20 0 0
		Dunbar			
		Dunblane			

Number of Shares issued.	Amount per Share	Name of Company.	Amount paid up per Share	Dividend per Cent. per Ann.	Price.
	£		£ s. d	£ s. d	£ s. d
		Dundee, old £29,687		4 4 0	
		,, new £33,851		2 10 0	
860	10	Dunfermline	10 0 0	6 0 0	12 12 0
		Dunkeld			
		Dunse			
		Dysart			
6000	25	*Edinburgh Gas Co.*	25 0 0	10 0 0	45 0 0
		,, *and Leith Co.*			
		£98,640		5 10 0	
		Elie			
		Elgin			
		Falkirk, old			
		,, new			
		Falkland			
		Ferry Port on Craig			
		Fochabers			
		Forfar			
		Fort William			
		Fraserburgh			
		Galashiels			
		Garlieston			
		Gatehouse n. Fleet			
		Girvan			
		Glasgow £122,500		7 10 0	
15000	10	*Glasgow City and Suburban*	9 0 0	6 10 0	9 0 0
		Grangemouth			
		Haddington			
		Hamilton £7500		8 0 0	
		Hawick			
		Helensburgh			
		Huntly			
		Inverary			
400	1	Inverkeithing	1 0 0	5 0 0	1 0 0
1200	10	*Inverness Gas and Water*	10 0 0	5 10 0	15 0 0
2400	5	,, new shares	1 5 0	5 10 0	2 5 0
		Irvine			
		Jedburgh			
		Johnstone, near Paisley			
		Keith			
		Kelso			
		Kilmarnock			
		Kincardine			
		Kinghorn			
		Kingskittle, Fife			
		Kinross			
		Kirkaldy			
320	5	Kirkcudbright	5 0 0	5 0 0	5 0 0
1000	3	Kirkintulloch, near Glasgow	3 0 0	5 0 0	3 0 0
227	5	Kirkwall	5 0 0	5 0 0	4 10 0
518	5	Kirriemuir	5 0 0	6 0 0	
		Lanark			
		Largo, near Leven			
		Largs			
		Lasswade, n. Edin.			
		Lauder			
		Leith			
		Leslie, Fife			
		Lesmahago			
		Leven			
		Linlithgow			
		Linton, n. Nobkeh.			
		Lochee, n. Dundee			
		Lochgilphead			
		Lochwinnock, near Paisley			
1200	1	Markinch	1 0 0	7 10 0	1 5 0
		Mauchline			
		Maxwell-town, n. Dumfries			
		Maybole, Ayrshire			
		Maryhill, near Glasgow			
		Melrose			
718	2	Mid & East Calder	2 0 0		2 0 0
192	5	Moffat	5 0 0		
13½		Montrose	13 10 0	7 11 1	
		Musselburgh			
		Nairn			
		Neilston, n. Glasg.			
		Newmills, near Kilmarnock			
		Newburgh, Fife			
		Newton Stewart			
		North Berwick, n. Haddington			
		North Queensferry			
		Oban			
		Peebles			
800	25	Perth	25 0 0	1 4 0	22 10 0
		Peterhead			
		Pittenweem			
		Pollokshaws, near Glasgow			
		Port Glasgow			
		Portobello, near Edinburgh			
		Prestonpans			
		Rutherglen, near Glasgow			
		Renfrew, n. Paisley			
		Saltcoats			
		Sanquhar			
		Selkirk			
		South Queensferry			
		St. Andrew's			
		Stewarton			
		Stirling			
		Stoneheavn			
		Stonhouse, Lanrks.			
		Stornoway			
		Stranraer			
		Strathaven, near Hamilton			
		Thurso			
		Tillicoultry, n. Alloa			
800	1	Tranent	1 0 0		1 0 0
		Troon			
		Wick			
		Wigton			
		Wemyss	4 10 0		
		IRELAND.			
300	10	Armagh	10 0 0	8 0 0	14 10 0
		Ballinasloe			
700	50	*Belfast*	50 0 0		
		Ballymena			
		Ballymona			
		Carrick-on-Suir			
		Carrickfergus			
		Carlow, new			
		Cork (see United General)			
		Clonmel Consumrs			
		Drogheda			
19,000	10	*Dublin Consumers*	5 0 0	7 0 0	6 0 0
		Dublin Hibernian (see United Gen.)			
160	25	Dundalk	25 0 0		23 0 0
		Dungannon			
1000	5	*Downpatrick*	5 0 0		
		Enniskillen			
		Galway			
400	10	Kilkenny	10 0 0	8 0 0	11 5 0
		Limerick (see U.G.)			
1725	5	Limerick Consum.	5 0 0	5 0 0	5 0 0
600	15	Londonderry	15 0 0	6 13 4	21 10 0
500	7	Lisburn	7 0 0	6 5 0	7 0 0
520	10	Lurgan	6 0 0	6 0 0	6 0 0
		Mallow			
		Monaghan			
		Nenagh			
418	5	Newtownards	5 0 0	4 0 0	5 0 0
		New Ross			
		Newry			
		Omagh			
125	20	Portadown	20 0 0	5 0 0	20 0 0
600	10	Sligo	10 0 0		
		Tipperary			
		Tralee			
		Waterford			
		Wexford			

Advertisements.

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A full Treatise on the Gas Light Monitor is in the Press, and will be ready for all interested in same in a few days, giving that useful instrument fair play. That part of the Patents which combines Heating and Lighting, and also one for Cooking by Gas, will in all probability be ready during the week.

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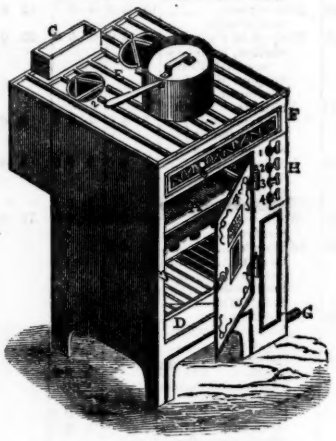

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Gas Valves and Sluice Cocks on an improved principle. Patent Gas Tubing and Connections.

A stock of the above articles kept.

The Pipes and Retorts supplied by M. K. are cast vertically, which ensures soundness and equality of thickness throughout.

THE Registered Cylindrical Gas Stove possesses all the advantages which belong to gas stoves in general, with the addition of many peculiar to itself; its great distinguishing merit is the internal arrangement, by which none of the gaseous vapour escapes into the apartment, so that a pure atmosphere is constantly preserved. It will be found of the utmost value in churches, chapels, manufactories, halls, libraries, bedrooms, nurseries, greenhouses, conservatories, &c.—Prices 28s., 35s., 40s., and 45s. each, at DEANE, DRAY, and DEANES, Domestic and Public Gas Fitting Manufactory, No. 3, Arthur-street East, London-bridge.

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The Company, in giving notice of these burners, present also an outline of their principle. The Golden Burner, shown by drawing No. 4, is the best bulb flame burner known; and this is accomplished by the currents of air to the flame being undivided, and by a perfect combination of oxygen and carbon; thus all the light is pure—the price is 3s. 6d., 4s., and 4s. 6d. each, complete. The Glass Burner, shown by drawing No. 5, being closed in with glass, is protected from external draughts, which produces results not hitherto attained in gas light. By the burner being supplied with a volume of warm air, the illuminating power of the carbon is not checked, and hence a pure and steady light is given—the price is 13s. complete. The Reflecting Burners, shown by drawings Nos. 6 and 7, can also be had as upright burners. These burners are the most shadowless burners made; the flame is very white and steady, they consume the gas that is entering into a state of combustion more perfectly than any burner hitherto produced (excepting the other burners here quoted, which are founded on the same principles). The burner No. 6, with reflector complete, is 7s. 6d. The burner No. 7 is 3s. 6d. complete. The company also have a burner which surpasses the Bude Light in every respect, and with only one circle of flame, and which can be screwed on to any fittings, price £2. 10s. complete. A very liberal discount is allowed to gas companies and the trade. The Company will simply quote one testimonial.

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"By the simple, yet truly scientific arrangement of your burners, you have succeeded perfectly in obtaining the proper supply of air, both in *quantity and position*: thus, the flame is, at all times, steady and intensely luminous, while even under suddenly increased pressure, or during draughts of air, no smoke is given off.

"I remain, Sir, yours faithfully,

"JOHN RYAN, M.D., LL.D., Professor of Chemistry.

"Mr. Richard Clark, Strand."